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USSR Report

SCIENCE AND TECHNOLOGY POLICY

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USSR REPORT

SCIENCE AND TECHNOLOGY POLICY

CONTENTS

SPECIAL PROGRAM PLANNING FOR BALANCED DEVELOPMENT OF SCIENCE AND TECHNOLOGY

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 2, Feb 84 pp 93-98

[Article by N. Kazakov and M. Lapin]

[Text] In the decree of the CPSU Central Committee and USSR Council of Ministers, "Steps to Accelerate Scientific and Technological Progress in the National Economy," it is deemed necessary to expand the use of special programs for planning development of science and technology. Starting with the 12th Five-Year Plan,All-Union, republic-level (interrepublic), sectorial (intersector) scientific and technological programs will be worked out, as well as programs for regions and territorial industrial complexes, the main tasks for which will have to be included in 5-year and annual plans.

Under the current Five-Year Plan, All-Union scientific and technological programs (which total 170) will cover a wide range of studies and projects aimed at development of fuel-energy and agroindustrial complexes, machine building, chemistry, metallurgy, transportation, public health care and production of consumer goods. They provide for cooperation of many organizations and enterprises under different ministries and agencies to solve the most important scientific and technological problems, develop and introduce to industry new equipment, technological processes and materials. Utilization of the most effective achievements of science and technology is planned for 41 of them already under the current Five-Year Plan.

Programs are instrumental in finding combined solutions for scientific-technological and socioeconomic problems in many sectors of the national economy. They enhance the special-program orientation of 5-year plans, permit concentration of resources of scientific research, design, planning-design and technological organizations for execution of the most important scientific and technological assignments. Thanks to the broad use of standard methods of forecasting the means of achieving the ultimate scientific and technological results in developing programs, it is possible to promptly detect an imbalance between scientific-technological and production potential of some organizations and furnish steps to correct it. Programs are of great practical importance to assuring balanced development of science and industry through long-term plans. In working out the basic directions of improving production, they can be used for engineering estimates to validate plans. Scientific and technological programs also play a positive part in preparing reference and standards materials for planning

economic and social development of sectors of the national economy, since they contain substantial information about the feasibility of changing to more progressive standards and norms in industry.

At the same time, there are still some difficulties and flaws in special-program control of scientific and technological progress. Assignments for conducting research and development are not always supported by the necessary resources for development of experimental-test and production base; not infrequently, there is unjustified duplication of topics; instead of practical use of results already obtained, individual institutions organize their own projects; there is not sufficient coordination between national and sectorial combined programs.

In order to improve the effectiveness of special-program management of development of science and technology, there must be clearcut regulation of the procedure for preparing and validating proposals to develop scientific-technological and special-purpose integrated programs, they should be separated into national and sectorial, determination must be made of criteria to evaluate the problems advanced. At the present time, these matters are being resolved mainly by experts. This does not preclude classifying some programs as national ones, when the authority of sectorial bodies would be sufficient to control them. The distinctive delegation of responsibility for solving sectorial problems on the intersectorial level, which occurs in such cases, does not help improve the effectiveness of special-program control of development of science and technology. At the same time, not all of the pressing programs are included at the proper time among the national ones. They have to be developed after approval of the five-year plan, which raises difficulties which are all the greater, the broader the problem to be solved and the higher the resource requirements to fulfill the program.

In evaluating a problem that is submitted for handling by programs, it is desirable to consider criteria such as timeliness of developing the program, its impact on effectiveness of national production, breadth of the problem, etc. As we know, the special-program method is particularly necessary and can yield a significant effect in controlling production processes with extensive cooperation of labor. For this reason, one can propose socioeconomic effectiveness and share of research performed on the basis of intersector cooperation, with the exception of the work done by the organization that is the principal one on the program, as the basic criteria for differentiation between national and sectorial programs. High socioeconomic effectiveness determines its significance on the scale of the national economy as a whole. When there is a rather large share of intersector cooperation in the program, the management capacities of sectorial bodies are limited, and for this reason it is best to assess it as a national one. If there is also an insignificant part of the program work done by intrasector cooperation, i.e., it is performed mainly by the chief organization, apparently one should analyze once more the desirability of developing a special-purpose combined program. The possibility cannot be ruled out that the problem in question could be solved by traditional control methods.

The difficulty of using the above criteria is due to the fact that, at the preliminary stage of preparing proposals for a list of scientific-technical and special-purpose integrated programs for the next 5 years, the expected socioeconomic effect, relative degree of intersector and intrasector cooperation

in the process of solving each problem can be estimated very approximately, with use essentially of expert evaluations and analogies to other programs that were developed previously. Considering the difficulty of establishing such analogies, to determine these parameters it is desirable to break down the problem in question into subproblems, on the basis of analysis of conformity of the problems solved to specialization of scientific research and experimental design organizations of the sector. The estimates thus obtained cannot presume to be definitive, but at the same time they help make the proper decision as to desirability of preparing national or sectorial programs.

Synchronization of program development is also important. This is attributable to the organic interrelationship between end goals of some sectorial and national programs, the need for optimum distribution of resources of sector organizations and performance of other planned assignments.

In the scientific-technological and special combined programs that are developed under the supervision of GKNT [State Committee for Science and Technology] and the USSR Gosplan, attention is focused chiefly on solving the largest problems with the participation of many organizations and enterprises under different ministries and agencies. Intrasectorial separation of labor in these programs is left essentially in itemization of measures. It is kept in mind that inclusion of a combined assignment in the plan of one of the sector's organizations is sufficient to assure the necessary intrasector cooperation in performing such an assignment. However, in some cases, a special sectorial specific-purpose integrated program is also necessary for effective special-program control of interaction between organizations and enterprises in the sector in the course of performance of the assignment. The results and time of fulfillment of a national program could depend on this.

Sectorial special-purpose combined programs are not always directly linked to national ones. In such cases, their end goals are determined from the results of scientific and technological forecasting in the sector and analysis of tasks put to the sector for the immediate future. As a rule, these programs are "resource-intensive" and require effective solution of problems with due consideration of production capacities of executors and distribution of resources among them. In spite of involvement of the leading specialists of the sector in preparing them, even with broad use of simplified expert evaluations of different variants, this process is quite labor-consuming and involves considerable expenditures. For this reason, it is more expedient to prepare the list of sectorial problems to be solved in the next 5-year period according to program in the first half of the current 5-year plan. It should be approved no later than 2 years prior to the start of the next 5-year plan, since preparation of programs is completed at the same time as the draft of the 5-year plan.

The wide spectrum of scientific-technological and socioeconomic problems put to sectors of the national economy determines the diversity of directions of scientific and production work, in which sector programs are prepared. Many of them involve development of new products. In machine-building sectors that specialize in the manufacture of intricate engineering complexes and systems of machinery, which include subsectors that put out the end product and prepare complete sets of it, such programs are sometimes called vertical, referring

to the hierarchy of production relations determined by the functional-design and technological breakdown of end products.

So-called horizontal programs constitute a special group; they are directed toward saving labor, material-technical, fuel-energy resources in the course of producing different samples of end products of the sector. They include programs for standardization and unification of products, units, instruments and systems used in engineering complexes, development and introduction of standard technological processes, refinement of organization and planning of production. They are not directly related to development of any product prototype, rather they permeate "horizontally" the first group of sectorial programs.

The end goals of vertical and horizontal programs are interrelated. Not infrequently, the end goals of the former have greater priority. They specify the basic directions of work of scientific research and experimental design organizations and series-producing enterprises in the sector. Analysis of the possibilities for improving the effectiveness of their work makes it possible to formulate the end goals of some horizontal programs. In some cases, they may have priority. For example, the end goals of programs aimed at reduction of manual labor, saving material and financial resources are determined primarily by objectives of intensification of production, which ensue from integrated technical and economic analysis of effectiveness of the sector's performance in the base period, as well as evaluation of socioeconomic factors capable of influencing it in the future.

In spite of the fact that sector programs differ in directions, it is important to prepare them on the same organizational and methodological basis. The latter provides not only for their organic interrelationship with sectorial plans, but combination of decentralization of control of individual programs with centralization of management of their entire aggregate at all stages, from elaboration of proposals to complete fulfillment of assignments.

As shown by analysis, in industrial sectors attention is devoted mainly to preparation and approval of programs. Many specialists have formed the opinion that if the programs are developed in good time and approved, by virtue of priority of assignments listed in them the planning agencies will include them in the sectorial plan, and then the program will be fulfilled according to plan without any additional organizational efforts. In preparing sectorial programs (particularly on tight schedules), sufficient attention is not always given to evaluation of their feasibility, balance between assignments they contain, executors' capacities and available resources. This makes it more difficult to fulfill them and, not infrequently, they remain as good wishes that have little bearing on the practical performance of sectorial organizations and industrial enterprises.

When preparing long-term programs, it is not always by far feasible to unequivocally define the composition of work, performance of which makes it possible to reach the goals; for this reason, in the course of fulfilling them one finds that additional measures are necessary. Moreover, deviations of actual results from planned ones could prompt a change in list of measures, in composition of executors, redistribution of resources, etc. Thus, a program cannot be

viewed as some list of planned assignments, that had been once defined and subject to strict performance. In the process of fulfilling the program, constant monitoring is required, as well as analysis of deviations of results and time of completion in order to make the necessary decisions in good time. Apparently, special control bodies are needed to perform these functions.

In some industrial sectors, such functions are assigned to commissions and worker groups, which include responsible employees of the ministry and specialists of sectorial scientific research and planning-design organizations, scientific production associations and enterprises. However, such commissions have substantial flaws: discrete mode of work, minimal responsibility for performing management functions and low quality of decisions, no economic leverage whatsoever to influence executors. Evidently, this explains the limited examples of successful performance of such commissions.

Adherence to principles of matrix structure of special-program control by means of giving additional power to certain elements of the sectorial linearly functioning structure of management of scientific and production activities of enterprises appears to be preferable. The elements in a system of bodies of special-program control formed in this manner correspond to levels of control of linearly functional structure. Thanks to this, direct "horizontal" ties between bodies of special-program and linearly functional management on the corresponding levels are simpler, it becomes possible to widely distribute authority, duties and information for decision making among them.

The lowest element, i.e., head organization, merits special attention in the sectorial system of bodies of special-program control. It bears the main burden of monitoring and analyzing the status of work done according to the program, preparing and validating variants of management decisions. Unlike superior organizations, to which executors are subordinated, the chief organization has full information about the scientific-technological problem in question, and it can combine functions of scientific-technical and organizational-economic management. For the head organizations to effectively influence the process of ongoing control of program fulfillment, bear full responsibility for reaching end goals at the scheduled time and wise expenditure of allocated funds, it is considered desirable (perhaps in the nature of an experiment for the time being) to implement several organizational measures to expand their rights.

No management body can work without being furnished with information about the status and trends for change in the object it controls. Consequently, such measures should be directed primarily toward gaining the necessary volume of information in accordance with the required regulations. It is necessary to determine the extent, to which statistical records can be used for these purposes, or whether additional information is needed. The answer to the last question is important, if we consider the fact that planning departments of enterprises are overloaded with preparation of diverse records and reference information for organizations that are above them.

As shown by analysis, the discrete nature of incoming reporting information to superior organizations does not permit the necessary operational management

of most special-purpose, combined sectorial programs, especially those where the manufacture of experimental prototypes of complicated engineering complexes or systems of machinery is planned, and the situation changes rapidly in the course of fulfilling assignments. Moreover, the data in the form of statistical records do not contain forecasts of expected time and results of work and its different stages. For this reason, the forecasts needed to make the proper management decision would have to be prepared by the chief organization, which does not have sufficient information about the status of production by the executors, which would have an adverse effect on the quality of management. This flaw is manifested to a full measure in management of national, combined scientific and technological programs, where record forms 2NT NPK are used, excerpts from which are forwarded to the chief organizations.

The substantial differences between checking-accounting and analytical information needed for ongoing management of program fulfillment and reflecting its specifics, on the one hand, and statistical reports that are intended primarily to sum up the overall results of group performance for the reviewed calendar period determine the desirability of developing direct information channels between the chief organization and executors. However, the existing statutes concerning socialist enterprises and other norm-related documents do not take into full consideration the specific problems that the head organization, as the body of special-program management, must solve.

So-called special-purpose financing could play a positive role in setting up direct information channels between the chief organization and executors of work according to the program. It enables the chief organization, as the client, to use an economic agreement as tool for special-program control in order to receive feedback from executors in the form of information as to status of work and estimates of expected dates and results of its stages, as indicated in the contracts.

The model statutes in effect at the present time about economic agreements [contracts] to perform work with a long production cycle limit the client's ability to effect ongoing monitoring and analysis of its status at the contracting institutions and take prompt action. The contractors are accountable to the client only with regard to the dates for completion of the different stages stipulated in the agreement, and they do not have to submit any analytical information, including projected estimates of results and time of completion of work. However, this problem can be solved if the standard [model] statutes concerning conclusion of economic agreements to perform work according to special-purpose combined programs include a list of the obligations of the executor concerning submittal to the client of checking-accounting and forecast-analytical information in accordance with regulations coordinated with him, as well as forms and indicators.

Some sectors of machine building have had some interesting experience in using automated control system resources for management of cooperation between organizations involved in fulfilling different special-purpose combined programs. The block of information about the set of jobs according to the program and their stages, executors, concluded agreements, results and time of completion, remitted advance payments and final payments are stored at the computer center of the chief organization. Print-outs of forms that are sent to executors are

prepared from this array periodically, with consideration of specifics of the program. They provide for minimal manual labor to be filled out. The filled-out forms are returned to the chief organization and fed into the computer. Regular information processing and renewal of the data file pertaining to the program not only facilitates checking and record-keeping on status of work and expense involved in performing it, but makes it possible to plan with greater justification all work and expenses with consideration of the actual status of program fulfillment and projected estimates of executors.

Since executors are not always interested in submitting to a client information about progress of work, and in the standard statutes on agreements this requirement is not included, such an automated system, which was named the Dogovor [agreement] ASU [automated control system] is aimed thus far only on intrasector cooperation. Organizations involved in fulfilling the program must submit checking-record keeping and projected analytical information in accordance with the regulation established by directives of the ministry's administration. The Dogovor ASU is based on an YeS series computer. Experience has shown that it would be expedient to modify it in a display variant, which simplifies significantly dialogue between man and machine. After it has been put in operation, the display version of Dogovor ASU, there will be reduction in labor-consuming processing of information and expanded opportunities for multivariant estimates in current planning of work according to the program.

Since the chief organization processes the entire volume of statistical and forecasting analytical information, the agencies of special-program control on the middle and upper levels are relieved of a considerable part of the routine work and concentrate on key problems, participate in examining differences of opinion between executors in intrasector and intersector cooperation, check coordination of different programs with one another and with the sector plans.

The head organizations play a particularly large part in planning and coordinating the work of program participants. They prepare coordination plans of research on the problems in question, and they must receive conformation that the work has been included in the plan from enterprises and organizations that participate in the program. Having detailed scientific-technical and statistical information from all executors, they prepare proposals for coordination and planning of work to superior agencies, and they prepare summary scientific and technical reports dealing with the problems in question.

When summing up the performance and determining the results of socialist competition among scientific research, experimental design, planning-designing, technological organizations, associations and enterprises for the reported period, it is apparently desirable to take into consideration the estimate of the chief organization concerning performance of work schedules according to program and other duties included in the plan in general form without giving any details. This would increase the authority of the work schedules, coordination plans, joint decisions and other special-program documents, by means of which the performance of many organizations and enterprises involved in the program is coordinated. Such documents will resemble planned assignments in their significance to executors. Since they cannot be corrected without the approval of bodies of special-program management, the latter and, first of all,

the head organization for the program indirectly acquire certain rights with regard to organizational and executive management.

In many sectorial scientific research, experimental design, planning-design and technological organizations, the main form of economic incentives is giving bonuses to workers according to quarterly performance. The principal requirement for a bonus is to fulfill a project plan referable to scientific research and experimental design work. For this reason, assignments that contain, in the opinion of executors, elements of risk as to target date are often not included in a plan, or are included with greater leeway, so that failure to meet intermediate target dates at different stages of work is not reflected in it. A paradoxical situation develops, where all organizations involved in a program, which is behind scheduled target dates, fulfill the target plan and are given bonuses for their achievements in the quarter. Since this does not help improve the efficiency of their scientific and production work, it would be desirable to review this practice. If, for example, organizations involved in a program are credited with fulfillment of a plan only when positively rated by the head organization, the latter, as a body for special-program control, will obtain a rather effective tool for exerting an economic influence on executors.

As noted above, financing the work through the head organization expands the possibilities for control of the program. Modern requirements as to fulfillment of contractual obligations by enterprises and delivery of series-produced items should be also extended to scientific research and experimental design work. It would be expedient to consider deviations from scheduled dates for all stages of scientific research and experimental design work also as an infraction of planned discipline in order to reduce the time spent on this work.

For the economic agreement dealing with scientific research and experimental design to become an effective tool of economic influence on executors of the program, it is necessary to revise the existing procedure for planning and accountability in terms of indicators of scientific research and experimental design work volume, according to which the client-organization considers the plan unfulfilled if the contractor has not performed the agreed upon duties. This situation often leads to a situation where, when there is an impending deviation of work progress from the plan, both sides strive to correct the plan, even if this would subsequently lead to negative end results. Evidently, it would be proper not to consider it an infraction of planned discipline on the part of scientific research, experimental design, planning-design and technological organizations when there is a decline in actual volume of services by involved organizations, as compared to the planned volume, if this did not, in turn, lead to defaulting vis-a-vis the other member of the agreement.

Introduction to practice of special-purpose combined programs has put quite a few pressing problems to economic science and management bodies. There is a need to summarize the knowhow being accumulated in solving them. Apparently, it is high time to prepare unified methodological instructions for the entire national economy, under the guidance of the State Committee for Science and

Technology and the USSR Gosplan, on how to prepare special-purpose combined sectorial programs and control their fulfillment. Apparently, some amendments will also have to be made in existing statutes and other norm-related documents regulating the rights and duties of organizations and enterprises participating in the program. When these and other problems related to introduction to industry of achievements of science and technology are solved, it will help implement the decree of the CPSU Central Committee and USSR Council of Ministers "On Steps to Accelerate Scientific and Technological Progress in the National Economy."

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NEW INSTITUTES FACE TREMENDOUS GROWING PAINS

Moscow PRAVDA in Russian 25, 26 Mar 84

[Two-part article by M. Korolev under rubric "Let's Assure the Effective Use of Scientific Potential: "With What the NII [Scientific Research Institution] Gets Under Way"]

[25 Mar p 3]

[Text] Does an Institute Need a Lot?

At first glance that question might seem strange. Of course institutions with different areas of specialization have needs that also are largely different: physicists specializing in nuclear studies cannot get along without a reactor or accelerator, and astronomers cannot get along without an optical or radio telescope. However, despite the entire obviousness of the dissimilarity, there is something else that is just as obvious: the success achieved by any scientific institution would be inconceivable if that institution does not have at its disposal modern research equipment, skilled personnel, competent administrators, and the proper working conditions for the personnel. Yes, in every specific instance this mandatory minimum is individual, but that does not mean that one cannot outline it.

It is a different case with the situation that engineer-designer B. Ursegov wrote an offended, indignant letter to the editor about. "I do not have my own work site and am counted on the rolls (as the not particularly gracious expression goes) as. . . a home worker," he reported. Then he went on to explain that another person who was not given a work site was his manager -- the chief of an equipment laboratory in the department for new methods of increasing petroleum extraction, of BashNIPIneft' Institute (Ufa). After toiling away without a chair or a desk in a subdivision where the subject matter is considered to be interesting and necessary, the designer quit at his own request, since he did not have the conditions for doing the job for which he was getting paid.

Of course, the lack of a place to sit down in a small laboratory consisting of seven persons could be evaluated as a vexatious episode, if he were a rarity. But, as people used to say in the olden days, alas and alack. . . The Institute of Geography, USSR Academy of Sciences, finds shelter in 24 basements throughout Moscow, and in that institute there are only enough desks for one coworker out of three. In a number of institutions of the MSSR Academy of Sciences, as many as

70 percent of the scientists in the humanities do not have work sites. Needless to say, this situation, which is forced by circumstances, is cheap, but one could scarcely call it promising.

For several years I have been collecting information about "indigent scientific outfits" and I am convinced that many, very many scientific institutions have not been provided with even tolerable conditions for fully valid work. In the most varied regions of the country, in the branch, academy, and plant sectors of science, and in higher schools you will find research and design collectives that are vegetating in disorder -- these range from a small laboratory to entire institutes.

Why, then, have their "owners" become accustomed to such an obviously absurd situation?

In order to answer that question, let us go back two or three decades in time. The end of the 1950's and the 1960's became a period of the explosive growth in the country of scientific institutions and the size of their personnel. That process -- which was called to life by the sharply increased need of the national economy for scientific services — was completely necessary. In the course of that process one saw the development of that powerful and varied scientific potential, thanks to which our country is able independently to resolve scientific-technical tasks of any complexity in any area of knowledge, and threatening our country with embargoes or the limitation of scientific contacts is absolutely senseless.

It is another matter that this rapid expansion of the front in the scientific search and the network of scientific institutions sometimes proceeded, if not uncontrollably, then without sufficient concern being shown for the equipping of the young institutes. The ministries and departments, it later transpired, were granted excessive freedom in setting up institutes. Frequently, in the branches and regions, that freedom was used thoughtlessly. Opening up NII [scientific-research institutes] and transforming ordinary pedagogical institutes into universities, in some places, because practically the fashion, and a question of prestige: how are we supposed to get along without a university, people asked, if our neighbors already have one?

With the passage of time, some limitations were set: the opening of an independent scientific institution of any caliber was authorized only with the sanction of the USSR State Committee for Science and Technology. But it was not immediately possible to slow down the speed that the vehicle had built up: the pressure from the ministries and departments was too strong. Even with the overview of the GKNT [State Committee for Science and Technology], in the late 1960's and the 1970's alone, 1,100 scientific institutions opened in our country. Recently a still higher obstacle was erected on the path of the powerful incoming wave: an institute can be opened only with the approval of the USSR Council of Ministers. This measure is supposed to help to prevent the appearance of institutes that have at their disposal a table of organization and a sign out front, but do not have the conditions for conducting a search that guarantees a complete return.

Because life will continue to advance newer and newer scientific tasks, and the creation of institutes is absolutely necessary. However, in the course of

optimizing the network of scientific institutions it is important to keep in mind that the not very prolonged, but headlong, stage of its extensive development left behind a rather large number of "do-it-yourself" scientific "outfits" -- if one were to compare them with farms, one would say that they did not have much land, they don't have any horses, and they don't have any motors.

Yes, it frequently happened that they were opened up on a "let's hope for the best" basis: for a beginning, we'll get settled in somehow, and then we'll see. Incidentally, much more frequently the road was paved with the best intentions. The situation involving the Institute of Physics, Dagestan Branch of the USSR Academy of Sciences is rather telling. Substantial guarantees were given when giving the "okay" to its opening: slightly less than a million rubles were allocated for the putting up of the building; its construction was included in the plan; and a contractor was assigned. Soon, however, the capital construction plan was adjusted, the project was assigned to the category of those with second priority. . . Year follows year, and the Dagestan physicists are still postponing the moving-in ceremony. To what extent do the CPSU oblast committee and the Council of Ministers of the autonomous republic plan to reconcile themselves to this?

The tortures of creating the experimental base of the Institute of Microbiology, BSSR Academy of Sciences, are also typical. The building was put under a roof as long ago as 1978. Since then the scientific coworkers have attempted, by their own efforts, to get everything they need to carry out their research. As the expression goes, if you want to set out to sea, you have to build yourself a boat. They traveled all over the country -- from Grodno to Magadan -- looking for and purchasing suitable equipment. As to who will undertake to install the equipment that had been purchased, they haven't the slightest idea. And as to when they will be able to activate the experimental capacities, they don't know. Meanwhile, time marches on.

But in science there is a special price for this. A person is grievously wrong if he thinks that it does not have any particular importance whether research is extended on a complete basis several years earlier or later. Take, for example, the special-problem and branch laboratories, which have been conceived as a means of moving ahead on comparatively narrow sectors of the scientific front. According to the information supplied by experts on science, the amount of time that it will take to staff and equip them, in our country, takes three to five years on the average. That's on the average! But during that period of time the groups that are attacking the scientific problems sometimes move so far ahead that the laboratory can become obsolete by the very first moment that research begins there. We might recall the headlong rush in electronics of the attacking wave that went from radio tubes, through transistors, then ordinary and large integral schemes, and then continued to roll ahead. A similar momentum is building up in the research on genetic engineering and biotechnology. Is it admissible in such cases to put a cap on the major efforts for five or more years?

Failure to pay attention to the needs of the newly born scientific institutions is frequently the fruit of a common delusion to the effect that the activation of a factory of plant is much more important than an institute: the enterprise will begin to produce output, but the fruit on the tree of the scientific search are still ripening. Doesn't this contain the answer to the question of why

certain institutes of the TuSSR Academy of Sciences cannot move out of the temporary structures that are poorly adapted for the conducting of research, although the republic's party and Soviet agencies have repeatedly promised, including promises made after criticism in PRAVDA, to correct those who had "frozen" the use of the funds that had been allocated for the construction of the institute's buildings.

Needless to say, the "launching" of an institute will not raise the indicator of gross production for the oblast or republic. However, people lose sight of the fact that a scientific-research institute with 500 scientific associates is equivalent to an industrial enterprise that produces output valued at 25 million rubles a year. If one is to avoid allowing these "scientific capacities" to stand idle, it is necessary to bring them up to their planned operational mode as quickly as possible.

Over a prolonged period of time, many branches and departments were insufficiently concerned about this. The negative consequences of this can be seen most graphically, naturally, in our country's largest scientific center -- in Moscow. A clear idea of this is provided by the following figures. Ten scientific organizations of USSR Gosstandart [State Committee for Standards], according to a report in the press, are situated at 99 different addresses in the city; eight that belong to Minnefteprom [Ministry of the Petroleum Industry], 38 addresses; and about a dozen that are subordinate to USSR Minugleprom [Ministry of the Coal Industry], 48 addresses. I do not know how it is about a house, but they definitely do not have a home. And there is a lot more like this. I read about an independent laboratory where the capital investment in terms of a single associate comes to only 110 rubles. We might estimate how much it costs to buy a desk and a chair. Then we might see that the laboratory's trustees have apparently accepted for all time the statement that was made at the beginning of the century by Robert Wood, to the effect that a good physicist, with the aid of a stick, a rope, some sealing wax, and his own saliva must know how to make any scientific instrument.

During three-quarters of a century much has changed in science, and during the era of its industrialization it is inadmissible luxury -- or perhaps one should say thriftlessness -- to maintain institutes with improper working conditions for the associates, or without the necessary equipment. Is it bearable for the subdivisions of the Institute of the Physics of the Earth, USSR Academy of Sciences, to be scattered over 16 addresses and to have only 2.7 square meters allowed there per living "scientific-technical soul"? Shouldn't we follow the advice given by Academician P. Kapitsa: organize the institutes in such a way that the scientific workers spend no less than 80 percent of their time in the laboratories conducting research.

The abnormal situation has not failed to attract the attention of the party and Soviet organizations in the capital. The general plan for the city's development provides for the relocation from Moscow of 342 scientific institutions with a total personnel of approximately 135,000 persons. It is difficult to say whether, in all the instances, this resettlement is the best step to take. But we also cannot reconcile ourselves to the vegetation of unorganized institutions. . . However, the planned program (incidentally, it does not promise any changes for the

better for the unorganized institutes that remain in the capital) is being fulfilled squeakingly: since 1970, scarcely more than 40 of them have been transferred. On the other hand, the ministries and departments are attempting to expand and even to open up in Moscow scientific and design organizations, many of which do not have, and probably will not have in the foreseeable future, any solid base for getting well organized.

There is a simple logic here: it is better, people say, to maintain a poorly equipped institute than not to have any institute at all. Should one be surprised that, with such an approach, many scientific institutions do not have any test-production areas or test stands, modern control-measurement apparatus, or computer technology? It is not in the last instance because of the weakness of the experimental base, for example, in certain scientific-research institutes in the country's agroindustrial complex that the share of research is 87 percent, but the share of development is only 13 percent of the expenditures. Isn't it here that one finds the basic reason why a considerable number of the results of their research just stays on the shelves?

Or take the Institute of Water Problems, USSR Academy of Sciences. As long ago as 1968 it was put in a rented first floor of an apartment building that had been intended for use as stores and public-nutrition enterprises. Subsequently the first floor was divided in two by temporary wooden ceilings. The illumination of the work sites is artificial. It is forbidden to install any computer technology or laboratory equipment in the area, and the energy and water supply is limited. The collective works not only in extremely cramped conditions, but also in conditions that are completely unadapted for the conducting of research. Nevertheless the collective has never been asked to express their views during the consideration of the most important problems that are linked with the transferring of river runoffs among the various drainage areas, or what tomorrow holds for our largest water drainage areas.

Does it turn out that the people who are right are the ones for whom an impoverished institute is better than none at all? Before agreeing with them, we might ask: is it really permissible to have a plant operate at half its rated capacity? Why, then, is a similar situation frequently considered to be acceptable in science? The well-established custom of reconciling oneself to this evil, the gravitation toward producing new, feeble institutes instead of equipping the existing ones properly -- all this attests to the fact that the ability to think in categories of intensive development arrives late in the sphere of organizing research. And one should try to be too sly in formulating the conditions of the task: the crux of the matter is not in opening up yet another institute and supplying the personnel only with adding machines and typewriters, or in not opening it up at all. The true choice lies on a completely different plane: how are we to achieve a situation in which the collective immediately operates with the maximum return on their efforts?

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2. Building Institutes Is an Art

Obviously, achieving a situation in which the institutes that have been created rapidly start "hitting it on all cylinders" is by no means simple. But it is necessary. The urgency of this task is especially growing in the light of the requirement stated in the decree of the CPSU Central Committee and the USSR Council

of Ministers, entitled "Measures for Accelerating Scientific-Technical Progress in the National Economy": the taking of decisive steps to reinforce all the links that are connected with the creation and introduction of new technology. And that means all! But, as is well known, the organizations that stand at the beginning of that chain are the institutes and design bureaus. A technically backward, creatively weak scientific collective cannot serve in that chain as a reliable basic link. It is a good thing that these instances, even they are numerous, are the exceptions, rather than the rule. But everywhere that they do exist, even one day that is lost because of inaction is an inadmissible luxury.

Among the urgent measures, the one that comes into first place is: achieve a situation in which everyone who participates in the birth of institutes must be required to have mastered the art of building them, and must have studied and critically interpreted the available experience. And Soviet science cannot fail to engage in this -- our scientists have an excellent knowledge of this "midwifery." Confirmation of this that is given in the literature that describes the birth and rapid development of an entire galaxy of institutions at the Siberian Branch of USSR Academy of Sciences. One could also obtain examples a bit closer to Moscow and with less longevity. In certain respects even the Siberians can envy the academy's Center for Biological Research in Pushchino: it was established immediately on a modern level. And there are other places where one can find this experience: the Institute of High Energy Physics, with an accelerator that was a record-breaker for its time, in Protvino; and the quite young all-union cardiological and oncological scientific centers in Moscow. Or we might recall the planned, gradual preparation for the establishment of the republic-level academies of sciences -- it was preceded by many years of work in the outlying areas by expenditures with the participation of outstanding scientists, and the establishment of academy branches there. Those scientific-organizational universities are a glorious achievement of socialism. Incidentally, it would be a good thing for scientists and persons specializing in scientific studies to take this point of view in analyzing the history of the development of our best scientific institutions and centers -- from the original concept to its coming of age, and to make use of the most valuable "standard" decisions made by A. Ioffe, S. Korolev, I. Kurchatov, M. Lavrent'yev, and other recognized collectors of scientific efforts, making their experience the property of the broad scientific and party public, and make sure that the newly made directors of the newly created institutes do not use the trial and error method in order find solutions for the organization of research that have already been found by our classic authors.

Obviously, each of these architects of research institutions had his own style, his own special approach to the construction of the research columns. However, the lessons that were taught by them contain a lot that remains of vital interest to this day for our command complement in science. For example, Academician M. Lavrent'yev adhered to the rule: create the institute "under the director," that is, plan it for a specific outstanding scientist, rather than go around looking for a person to head a collective that has already been staffed. Before establishing an institute, it is necessary to be concerned about the formation of the scientific environment that is necessary for it, and about the cadre potential -- that idea guided those who were preparing to dispatch the remarkable Leninist train of science that carried to Tashkent the scientists who constituted the skeleton of the future university, the first in Central Asia. The crux of the matter is not that many organizers of science, especially in branch science, interpret anew on the

basis of their own experience, at times extremely lamentable experience, these and other golden rules in the art of building institutes.

One of the basic rules of the art of building scientific institutes consists in the assertion that they should be opened only where and when this is influenced by the actual needs of the national economy, and when a material base and cadres have previously been prepared. It is high time to made more rigid inquiries from those who disregard this formula. Because, as when a child is being born, any midwife miscalculations during the birth of a scientific institution cost dearly -- they must be eliminated, rather than corrected. As has been noted by specialists, the time of cheap science has passed. We already have institutes where the conducting of a single experiment costs an average of approximately a million rubles. This makes the chronic flaws during their organization all the more intolerable.

For a long time scientists have been discussing how to correct these flaws, if they have been committed. Probably everyone will agree that the most obvious alternative -- the rapid supplying of all the needy institutes with technology and an experimental base -- is not very realistic: too many scientific-research institutes do not have an experimental base, the correction of their situation by this means would require very considerable investments, and it rests upon the weakness of scientific instrument-building. And so the opinions diverge again. Academician A. Tselikov, for example, is a proponent of the most decisive actions: if an institute does not have an experimental base, it is necessary to close that institute -- it is just so much ballast. His opinion is seconded by those who view the institutes that have been supplied only with adding machines as an overextension of the ministerial apparatus, an overextension that has been covered over by a fig leaf.

However, despite its obvious reasonableness, this proposal can scarcely be considered acceptable. Especially since it would be difficult to carry out. And not because of the exceptional "unsinkability" of scientific institutions: as has been accurately noted, it is easier to open up a dozen institutes than to close down one ineffective laboratory. But finally people have learned how to overcome this obstacle. During the past few years alone, in the course of work that was extended on the initiative of USSR GKNT to systematize the network of scientific institutions, 145 institutes have been closed, and several dozen more have been combined with others. The chief obstacle lies in deciding who will assume the scientific servicing of the appropriate branches and subbranches of the national economy, because, for many of them, the weak institute is the only one they have.

A number of specialists see the way out in transferring a significant number of the "have-not" scientific-research institutes to large-scale enterprises, the experimental shops and production entities of which will become the test grounds for the practical verification and modification of the results of the scientific developments. There is another recipe that is similar to this: for the same purpose, considerably expand the network of scientific-production associations, including as part of their makeup the scientific-research institutes that are rich in ideas but poor in experimental capacities, and transfer a number of institutes to already existing NPO [scientific-production associations], since not all of them have within their makeup strong scientific association. There are also many proponents (as well, incidentally, as opponents) of recommendations to subordinate to these scientific-research institutes the small and medium-sized enterprises and thus resolve the problem.

Conclusions that are very interesting are those made by Academician B. Paton: investment of funds for the re-equipping, remodeling, or even the change in the area of specialization of the existing institutes pays for itself and yields a benefit, as a rule, that is considerably faster than the creation of new ones.

Obviously, with a consideration of the prospects for scientific-technical progress, the needs of science and the economy, and the real opportunities, it is necessary to make intelligent use of all the enumerated methods of optimizing the network of scientific institutions. Most of them, incidentally, have successfully passed their practical test. There is wide knowledge of the successes achieved by the scientific-research institutes that have been attached to Uralmash and Elektrosila, and by a number of scientific-production associations, for which the institutes are acting as the leaders. VNIImetmash and certain other scientific collectives have had plants transferred to them. Depending upon the specifics of the branches of the economy and the areas of knowledge, the ministries and departments can and must make skillful combinations of these already time-tested alternatives, and must search for and verify in action the new ones, maintaining a course aimed at the most complete use of the potential of all the scientific institutions.

The data provided by the system of equipment registration for their technical base could become a good support when choosing the best resolutions. Obviously, the time has come to undertake this system of equipment registration so that every department will not only ascertain the "have" institutes and the "have-not" institutes, but also to plan a clear-cut program of actions to provide them with accommodations, equipment, instruments, and computer technology.

However, serious interference will arise on the path of implementing this program. The fulfillment of the assignments for the activation of the experimental bases, plants, shops, and units at the scientific-research institutions and at the enterprises (construction sites with a value of more than 3 million rubles) since 1975 has steadily dropped; in certain years by as much as 44 percent [syntax obscure; alternative interpretation "to 44 percent"]. Something that will become a powerful stimulus for movement in the opposite direction is the fact that the assignments for the construction and remodeling of experimental bases and production entities, according to current decisions, will be included on a first-priority basis in the five-year and annual plans. This will help to break the unhealthy tendency.

It is also time to overcome another, no less alarming tendency: in academic science there has been an increase in the number of buildings that have been erected but which remain empty -- because of the shortage of equipment, there is nothing with which to "stuff" the boxes. This is the consequence of the firmly ingrained practice of planning without any kind of coordination the capital construction and production of scientific instruments and equipment, a practice which has also affected other sectors of science.

Accelerating the changeover of science to conditions of intensification, it would seem, would also be helped by other organizational measures, including those that have been practically tested in industry. What is preventing, for example, the use of the appropriate norm lists to limit the maximum time periods for the formation of institutes, as was done with respect to enterprises? Is it justified for the decision concerning the creation of a scientific-research institute to be made frequently when there has not even been any mention made of it? Would it be

a good idea at this stage to limit oneself to preliminary consent, confirm the organizer-director, and elevate the new construction project-institution to the rank of existing one after it has been provided with its "start-up minimum"?

It would apparently be worthwhile to grant in science the rights of citizenship to the concept of the institute's start-up complex. A GES without a turbine, a clothing factory without sewing machines will not be accepted for operation. Shouldn't the same thing apply to limiting the opportunities of those who are ready to consider a philology institute to be in operation although it lacks a library? In particular, by making the condition in a mandatory manner: we will bless the opening of the institute only after its start-up complex has been formed. Anything above that is at the discretion of your department, but if you have less than that -- even by so much as a single chair -- don't ask us to accept it.

There is yet another painful problem that is still awaiting its urgent resolution. The parallel erecting of production facilities and housing and other projects for social and everyday needs is increasingly becoming the norm for industry, but not for science. The consequences are: recently, outstanding engineering structures were activated -- the world's largest 6-meter optical telescope and radio telescope of the USSR Academy of Sciences in the Northern Caucasus -- but 40 percent of the associates in those scientific collectives do not have any apartments. The foundations of two 144-apartment buildings have been laid, but there is absolute silence at the construction areas: there is no money with which to pay the construction workers. But who will service the telescopes? A similar situation prevails at the other end of the country -- in the Khabarovsk institutes of the Far East Scientific Center. USSR Academy of Sciences allocated 2.5 million rubles to them for housing for their associates, but the construction workers "accepted" only half a million. Do we really think that anyone seriously counts on attracting highly qualified specialists to the shores of Amur without offering them apartments?

The considerable acceleration of the construction rates of the scientific projects -- both those for research and those for social and everyday needs -- is an effective means for providing aid to the institutes that need it. It is no less important, however, to make more complete use for this purpose of the resources that the scientific institutions have at their disposal. Those resources are tremendous. While being distressed about the needs of the "have-not" collectives, let us not forget that many of them have very rich -- at times, too rich -- relatives. Here and there the people's controllers discover equipment that is not installed even though it is scarce for others, or modern electronic computers that are operated only 3-4 hours a day. . .

No, it is not a matter of "from a lot, take away a little" -- that kind of redistribution can be squeakingly carried out within the confines of a department and encounters resistance as soon as it is necessary to transfer something from one branch to another. In science too the "fat cats" hang on tightly to everything, however small. . .

It is another matter when it comes to mutually advantageous cooperative action in the use of instruments, units, machine-tool and other equipment. The notorious "you give me and I'll give you" transactions are worthy of ridicule when they

are undertaken by private and nonprivate citizens to circumvent the moral norms. But if the institutes in a large city establish a joint fund of instruments, if, by way of payment or in exchange for other services, they undertake to carry out experiments for their colleagues on scarce equipment during the hours when they themselves are not using them, if they form a pool of rental scientific equipment, or open up a measurement center for collective use -- that kind of cooperative action outstandingly contributes to the effective use of the scientific potential.

How this looks in the practical situation can be seen from the following two examples. The Dnepropetrovsk Center of Cooperating Institutions of Higher Learning for the Servicing of Scientific Research -- an independent organization operating on principles of cost accounting -- has at its disposal test and measurement laboratories, a computer center, and repair shops. During the past three years it has fulfilled, on the basis of production orders from the institutions of higher learning and scientific institutions in the region, various operations with a total value of more than 2 million rubles, making it unnecessary for them to purchase equipment which each of the customer organizations could not operate completely itself.

Another path to a similar goal was selected in Tomsk, where an experimental-production complex was formed by cooperating institutions of higher learning. The subdivisions that make it up are not removed from subordination to the institutions of higher learning or the scientific-research institutes, but remain on their balance sheet and interact with one another on the basis of economic contracts and the exchange of services. Thus, if one of the institutes has a sector for the production of plastic articles, it fulfills orders not only for its own collective, but also for other participants in the cooperative effort. They, in their turn, accept production orders for what they themselves are rich in -- they deliver printing plates, perform welding operations, etc. The coefficient of use of the research instruments has more than doubled, and for the computer technology it is 1.5 times higher than the average for the country. That means that many of those who previously had no access to them have now received that opportunity.

Yes, it is necessary to use accelerated efforts to develop scientific instrument-building, since it is inconceivable to remain reconciled for a long time to the situation in which the need of the scientific institutions for instruments for research in certain branches is satisfied on the average by only 35 percent. And it is necessary now to make the broadest possible use of the centralized servicing of scientific research as an effective means of easing the shortage of the instruments that that research requires. And it is a good thing that that service is developing. The experimental-production complexes that have been intended for this purpose have appeared in Leningrad, Kalinin, and Ufa. USSR Minvuz [Ministry of Higher Educational Institutions] has enacted a decision to create nine centers of cooperating institutions of higher learning, three of which -- the Kiev, Belorussian, and Urals Centers -- opened in 1983. It is high time to take the experience that has proved its value and apply it more boldly beyond the confines of the higher schools.

Tracing the tendencies in the development of science, Academician S. Ol'denburg called the eighteenth century the age of academies; the nineteenth century, the age of universities; and the twentieth century, the age of scientific-research

institutes. They play a tremendous role in all the basic sectors of the development of our economy in the light of the decisions of the February 1984 Plenum of the CPSU Central Committee, whether we are speaking of intensification, the accelerated introduction of the achievements of science and technology, or the carrying out of large-scale comprehensive programs. It is all the more important to put the creation of a scientific-research institute on a scientific basis, to introduce a planned principle into that process, to switch it over to conditions of intensification, in order for the institute's capacities to be used completely and for them to begin to produce a return within the shortest possible periods of time, and also for the already existing capacities to increase that return steadily.

5075
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NARROW DEPARTMENTALISM HINDERS COMPUTER INDUSTRY PROGRESS

Moscow SOVETSKAYA ROSSIYA in Russian 20 Mar 84 p 2

[Article by Academician Yu. Nesterikhin, director of the Institute of Automation and Electrometry of the Siberian Department of the USSR Academy of Sciences (Novosibirsk): "Approximation of the Standard"]

[Text] The experience of many developed countries and the examples of the leading domestic enterprises attest that today 50 percent of the increase of labor productivity is due to technical innovations, and 15 percent is due to the use of computers.

Our academic subdivision--the Institute of Automation and Electrometry of the Siberian Department of the USSR Academy of Sciences--is called upon to provide the national economy of the country with developments in the area of computer equipment. Equipment which, as no other, is rapidly being updated and improved, at times leading significantly in development the notion about it, which exists among representatives of industry: engineers, process engineers, designers. I will cite a typical example.

The meter made of a special platinum-iridium alloy, which is stored deep under the ground, in the vaults of the USSR State Committee for Standards, as is known, is the main gauge of standard measures of length. And so that this standard could be used in case of the production of a complicate part, say, at one of the enterprises of Novosibirsk, it is necessary to make a copy from it, and then a copy from the copy, which upon arrival at the plant will also become the standard. At each stage of the measurements in this case errors will accumulate.

Scientists have proposed to use as the standard the length of a wave of radiation of a special laser. According to the laws of physics it is the same everywhere--in Moscow, in Novosibirsk and in any other city. A simple instrument converts it into centimeters and decimeters, which are customary for us. The result is at hand--the copying and delivery of the standard to the enterprise are not required.

We developed the unit and jointly with the Ministry of the Machine Tool and Tool Building installed the laser directly on the machine tools. But in the State Committee for Standards this evoked an intense discussion. And not only because it is impossible to feel or see with the unaided eye the length of the

wave, in contrast to the standard meter. If at the same time as the increase of the precision of machine tools the corresponding increase of the expenditures in the system of standardization were also suggested, it would be possible also to "forgive" the apparent "immateriality" of the electromagnetic wave. But what is being proposed in reality? To increase the accuracy of measurements directly on the job, having decreased in this case the expenditures on the copying and storage of the standard measures of length. Here the consciousness of the sectorial specialist also resolutely opposes this. Narrow departmentalism in the national economy creates the conditions for the preservation of old methods. The laser measurer is not the meter to which everyone has become accustomed. But it would be all right if only this problem hindered the introduction of new technology. For the proposed method includes the laser (one department) plus digital electronics (another), a computer with a control system (yet another department). Here the laws of the checking of introduction already of an interdepartmental nature come into effect. For many years they have not made it possible to introduce the standard of length, which is widespread in the world.

One happens also to come across the other extreme in case of the assimilation of computer equipment. Some enterprises, while advocating in words the use of the latest scientific thinking, purchase a computer unnecessarily, roughly speaking, "for furniture." And as a consequence incompatible things--high-speed computers and a conveyor, which in practice lacks means of automation--get on in the same shop.

But the whole point is that computer equipment, as a means of the automation of the intellectual and production processes of the activity of all of society, requires special troubles during operation. A talented programmer is equivalent to 100 mediocre programmers; a computer with developed software is equal to 1,000 computers without programs. Therefore, if you deliver to a plant some ultramodern electronic device, without in this case having properly trained specialists for its running, you will not obtain the anticipated impact from the introduction of new equipment. Taking this into account, we are doing everything which depends on us in order to change the traditional relations in the triangle "science--the higher educational institution--production."

Back in 1972 the Institute of Automation and Electrometry of the Siberian Department of the USSR Academy of Sciences set up a special design bureau and since then has been turning over ready documents to the pilot plant, having organized there a section for the adjustment of the equipment being developed. Moreover, with the assistance of the Novosibirsk Oblast Committee of the CPSU and the Presidium of the Siberian Department of the USSR Academy of Sciences the institute set up intersectorial design divisions at two industrial enterprises of Novosibirsk, at which specialists of the Academy of Sciences, who have transferred to the sectors, directly implement joint developments. The specific coordinating plans of the institutes of the Siberian Department of the USSR Academy of Sciences, the higher educational institutions and industrial enterprises of Novosibirsk are also helping it in this. The symbol of the Siberian Department--the sigma--seems to personify the summation of the efforts of the interested parties when solving key problems.

Such an organizational form made it possible, for example, to create the conditions for the simultaneous performance of scientific research and experimental

design work in parallel in two sectors. At the Novosibirsk Instrument Making Plant imeni Lenin the difficulties in case of the development of optics and precision mechanics were successfully overcome. As a result, without the disturbance of the existing departmental structure it was possible to make substantial progress in the development of optical electron systems--the input-output of an image in computers, laser methods of measurements.

Computer equipment is not simply one of the large number of equal components of scientific and technical progress, but its "intelligent" component, which performs the role of a catalyst in the development of the national economy. Computers are the keys to progress. And the tasks, on which scientists are now working, once more confirm this.

Among these tasks are the use of powerful computers (more than 100 million operations a second) in case of complicated calculations in the sphere of scientific research and experimental design work. The development of artificial intelligence, the turning of computers into devices which imitate thought processes, that is, are capable of drawing conclusions and learning. Such systems are already today capable of arriving at a diagnosis of an illness and of detecting a deposit of minerals.

"Expert" programs and systems of the verbal input of information are being developed. Artificial "sense organs," first of all artificial "sight," which is capable of perceiving objects in real space. The development of self-programming computers of "the fifth generation," the use of which will make it possible to optimize the organization of the production process, to decrease the amount of commodity stocks by 5 percent and to increase labor productivity by 20 percent, is also on the agenda.

Much can be said about the current problems of computer engineering, problems which to an equal extent are scientific, technical, economic and even social. No matter how difficult they may seem at times, it is necessary to solve them without delay. General Secretary of the CPSU Central Committee K. U. Chernenko stressed this once again in a speech to the voters of the Kuybyshev Electoral District of the capital: "It is absolutely necessary for us to ensure the rapid and continuous updating of all the sectors of the national economy on the basis of the modern achievements of science and technology. This is one of our vital tasks. Without this the progress of society is simply inconceivable." Enormous work on the development of machines, devices and processing methods of both today and tomorrow awaits us. The automation of production has to be accomplished, the most extensive use of computers and robots and the introduction of a versatile processing method, which makes it possible to change over production quickly and effectively to the making of new products, have to be ensured. It is necessary to begin to implement such a uniform scientific and technical policy.

7807
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ACADEMICIAN GLEBOV ON 'SCIENTIFIC' FILMS

Moscow SOVETSKAYA KUL'TURA in Russian 31 Mar 84 p 5

[Article by Academician Igor' Glebov, chairman of the Presidium of the Leningrad Scientific Center of the USSR Academy of Sciences: "Seek the Unknown Together"]

> [Text] How can the modern cinema tell about science and its main motive force, the talented scientist? Probably, every director and actor has his own answer to this question.

But it seems to me, however, that there are a number of indispensable requirements, without the meeting of which a reliable film on the researcher and his work cannot arise. I would also like to state some desires to our cinematographers.

I have in mind first of all the difficulties, with which any new scientific idea is faced when winning its "place under the sun." It is a matter here not of someone's conservatism, although, of course, one also happens to come across it. Some time simply should pass without fail, so that one's associates would begin to understand the new thing which has arisen in the head of one scientist, so that they would support it, so that this new thing would be made a part of the intellectual wealth of society. I will not go far for examples, but will touch upon the theme, which has already been developed of cinematrographers in the popular science movie "Never Say 'Never'." Autowave processes--a universal phenomenon which is observed everwhere that the process of the self-organization of matter occurs--are told about in it. Chemist Boris Belousov noticed them for the first time accidentally, as often happens in science. However, all the leading scientific journals rejected the article, in which his experimental observance was set forth: what the author had written about was too strange. And only after a decade and a half, when a mathematical model of autowave processes had been developed of Corresponding Member of the USSR Academy of Sciences G. Ivanitskiy and an entire series of experiments had been conducted, did a new area of knowledge--synergetics--arise.

So when you watch many films, you notice that this aspect of real scientific creativity appears on the screen in a very superficial and conventional interpretation.

Further, in science here is what one happens to come across all the time. Researchers frequently head for the same goal, but by different routes. And one of them, of course, proves to be more effective: it requires fewer expenditures and leads more quickly to the end result. Sooner or later one has to accomplish a very difficult task--to choose just one means. But a scientist first of all is carried away by his own ideas and far from always strives to look into the concurrent work. To admit that the work of colleagues is better than yours, to curtail one's own research and to turn to something else is always a tormenting process. Each of us at least once in our life has been faced with something like that. I have also not happened to see films on this. But here it is also not necessary to invent something, here is the drama of life itself, which frequently is more fascinating than any daring fantasy.

Let us take, for example, an area dear to me--the building of modern turbogenerators. Today in our country they are being produced in Leningrad, Kharkov, Novosibirsk and Lvov. Every collective wants to invent something of its own and to introduce its own development. But, by taking this path, we are creating for ourselves a heap of difficulties. The way out of this situation is clear: it is necessary to develop a single series of turbogenerators, in which the best design decisions, which have been proposed by specialists, would be summarized. Today such turbogenerators are already being built, but before making this decision we had to live through a time of difficult disputes. What has been said is one of the examples of the development of complicated modern equipment, in which one must subordinate personal scientific and design "biases" to the common interests--the development of equipment which is superior to the best foreign models. So why do cinematographers not direct attention to such situations? It is necessary without fail to tell how difficult this path is, how much effort, time and life itself a researcher spends on the realization of his ideas; to show that in the work and the life of even a recognized scientist, who has been crowned with "academic laurels," far from everything is smooth and far from always.

Since we have begun to speak about the life of scientists, we would like the main thing in the films about them--documentary or feature--to be evident: the interest in one's own work and mighty creative impulses have the result that the real researcher works always and everywhere. While sitting at his desk, while in the laboratory or even on vacation, he forgets about everything that does not have a bearing on the subject of his thoughts. This continues from month to month, from year to year, until the end of life. But, alas, how often in the films about scientists their cinematographic life takes place at sterile "spiritual heights," in the sphere of such conventional abstractions, that you immediately cease to believe in the reliability of the image.

I believe that all the same a closer and more continuous connection between those, who make films, and those, who work in science, is necessary. In just the same way as an actor gets used to a role, here it is necessary to associate longer with the people who are engaged in the elaboration of a scientific problem; jointly with scientists to seek such a form of the presentation of its essence, which would be interesting to the viewer.

In this connection I would like to make one practical suggestion. In the subtitles, which tell about science, there is "scientific consultant so and so." But, first, the very choice of a consultant is not always apt and, second,

even the authoritative, but only consultant can be biased. The end result of this is known in advance: all the wealth of the scientific problem is not revealed. It seems to me that the director should not confine himself to one consultant, to one research trend, to one scientific school. He needs the assistance of several well-known specialists. The right of choice of the best version remains, of course, with the artist-cinematographer.

What kind of films would I like to see? Well, first of all about the scientists, whose names are the pride of our science. Of course, about Kurchatov, about his brilliant ability to unite the efforts of completely different people for the accomplishment of a single task. I regard the film "The Choice of a Goal" only as a preliminary "application." A movie story about Academician A. Ioffe is also needed. He gathered around himself a group of most talented people, among whom were both I. Kurchatov and A. Aleksandrov, the current president of our academy. Precisely Ioffe, at the Leningrad Physical Technical Institute, back in the 1930's understood all the importance of the thorough study of the atomic nucleus. By the way, the group of enthusiasts of nuclear physics by no means encountered universal support at that time. Moreover, there were quite authoritative specialists who asserted that the conducting of such research was a waste of time and money. Imagine, what enormous scientific boldness, what sureness that one was right that one had to have into order to continue this work during those years. Somewhat later, when, on the recommendation of A. Ioffe, I. Kurchatov was appointed director of the atomic project, he was able to win over to his side exceptionally loyal people, who worked with enormous exertion, sparing neither pains not their own lifes. Brilliant scientific results were obtained, and an atomic bomb, which put an end to the American monopoly and enabled our country oppose any threats of imperialism, was developed in the shortest possible time. The account of this feat of Soviet scientists is an indisputable duty of cinematographers.

But why not make a film about a still unsolved problem, for example, the thermonuclear problem? The development of thermonuclear reactors requires vast material expenditures, an enormous amount of human labor, the efforts of the most talented people and skillful organizing work.

In 1977 and 1979 documentary film makers turned to the story of the thermonuclear physicist, but these short films and the well-known feature film "Nine Days of One Year" no longer reflect the present state of the problem, which is in the process of constant development, and immediately in several promising directions.

Having seen some popular science film, frequently, unfortunately, you see that the account about some event was not brought to an end, the technological process was given in separate "pieces," the researcher's find was turned toward the viewer with only one facet of it. It is understandable that it is difficult to speak about complex phenomena and processes, but this can and should be done. But nevertheless we have so far not found people who would undertake to work on a film about the same, say, superconducting turbogenerators. And there is another desire. Modern science has become the affair of collectives of many thousands. Millions of people work in the sphere of science, and in this respect it differs in no way from any other sector of the national economy. At the same time science is that sphere of human activity, in which the

success of the matter depended and depends on those who work here, on their enthusiasm, on the originality of the ideas being advanced. All the greater is the merit of the scientist-organizers, who can organize and manage collectives of like-minded researchers and can arrange the work so that priority would be given not to the operations, which are interesting to the individual scientist, but to those which promise the greatest theoretical or practical yield.

More vivid examples of such selfless service to science as the activity of such presidents of our academy as A. Nesmeyanov and M. Keldysh will hardly be found. People of thorough and extensive knowledge, great adherence to principles and exceptional benevolence, they were able to create when discussing any scientific question the creative atmosphere which made it possible to make the only correct decision. I am confident that the feature and full-length films on them would be greeted with enormous interest by all Soviet viewers.

7807
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INNOVATIONS, NEW PROCEDURES LACK IMPLEMENTATION

Moscow RABOCHAYA GAZETA in Russian 17 Jan 84 p 2

[Article by Yu. Porogelov, deputy prorector for scientific work at the Kharkov Polytechnical Institute imeni Lenin: "Row Upon Row of Gold Mines"]

[Text] It is hard to remember whose idea it was to develop the trolley with elastic torsion elements for the new tractors. What is important is that the cooperation between plant designers and VUZ scientists was fruitful. The trolley movement is twice as smooth as existing models. It weighs 13 percent less and prime cost is cut almost one-third. In fact, in terms of all parameters the development possesses considerable technical, operating and technological advantages. It has fewer parts, and about 30 percent of them are standard items.

But it was developed long ago, in 1970, and in the intervening decade and a half it has not come one single step closer to the conveyer belt. There are no objections. Everyone is "for" it. But nothing has happened. If they cannot justify it, at least the tractor builders understand. The plant is under reconstruction. For objective reasons the tracked version of the machine has remained in the shadows. But now the hour has come!

Of course, our paramount duty is to train skilled personnel. But the competence of tomorrow's engineer and his technical erudition are formed in the scientific quest in urgent production tasks. And for the student, participation in their realization has become a true school. But every failure in introduction evokes a negative response in him, and sometimes skepticism. The keen and public statements of V.A. Yevstratov, who counseled in favor of the extensive introduction of cold extrusion of parts, have not been taken into account. Accuracy in fabrication at third- and fourth-class levels, that is, extra machining, has in most cases been discarded. In addition, extruded parts acquire a specific microstructure and macrostructure and this improves durability and wear resistance. When you talk with the plant technologists, everyone knows, everyone understands this. But try to get the thing introduced... And then the reconsideration starts; and some say it helps and others say it hinders. Meanwhile, the experience of the bicycle plant and a number of enterprises in the machine toolmaking and electrotechnical industries shows that the coefficient of metal use in extrusion is as high as 0.9. Labor is saved and energy costs are reduced.

For the enterprises in Kharkov that have pledged to fulfilll the five-year tasks without increasing resources this is an invaluable help. But no, the old way is simpler. Two plants alone, namely the Serp i molot and the Porshen, each year shave off almost 3,000 tons of rolled metal into metal chips. The question of such mismanagement has repeatedly been raised. The plants cheerfully accept the criticism, define short-term goals, offer assurances... And everything just goes back to the way it was. And sometimes the introduction of an innovation entails a whole chain of problems that must be foreseen in good time.

A cold and hot forging section with an annual capacity of 5,000 tons of forged metal was created at the forging and mechnical plant in Lozovaya using a design developed at the Gidrotraktorsel'khozmash Institute. It was set up with very highly productive equipment. But the return was negligibile. There is no auxiliary equipment and a shortage of specialists. And this was several years ago. What should have happened was that the links with the people at the polytechnic should have been set up beforehand; after all, the institute is not at the other end of the earth.

Together with the Vilnius planning and design bureau for mechanization and automation work is being done on extrusion of parts for lathe attachments. The developments are being introduced at many plants in the machine tool and tool building industry. It has been calculated that this will provide an opportunity for saving at least 5,000 tons of metal annually. And in our oblast alone, particularly at the enterprises of the Ministry of Tractor and Agricultural Machine Building, they are stubbornly shutting themselves off from this very promising innovation. The professors struggle on, the docents know no rest. And the students get involved in this mad whirl of events. The calculations are made and convincing experimental proofs elicited, the amounts of the gains are known. The only thing lacking is some real return.

The desire on the part of the institute laboratories to complete every development at the level of an invention is not a matter simply of the scientific prestige of the VUZ or the scientist. There are also educational criteria that focus the student on maximum results. If it is a machine, it means a productive machine, a machine that lasts for a long time. If it is a technological process, it means less energy consumption, the lowering of labor expenditures, making a good quality product.

And still, by no means all our proposals are met with open arms. Since the beginning of the five-year plan the institute has obtained 626 positive decisions regarding the issue of certificates of invention. That is, work has been completed that is distinguished by its innovative and original nature and guarantees gains. And even though the lion's share of these developments has been carried out in cooperation with plant specialists, barely 300 of them have been used. Designs that promise gains of thousands and even millions, gather dust on the shelves.

Here, much depends on the reliability of the contacts between the VUZ and the enterprise, and on their mutual interest. One example of this kind of cooperation is our link with a production association that makes nuclear turbines. More than half a million rubles--this is the annual result of the cooperation

realized in designs and developments. Ten departments and two problem laboratories and a sector laboratory resolve common problems with the turbine builders. The plant specialists and designers have their own people at the institute. Our scientists have a fine appreciation of production problems.

Branches of the institute laboratories and departments operate at the enterprise, concretizing the areas of application resulting from the efforts of the VUZ scientific workers. Student training has become more purposeful and the time that they take to adapt to production has been shortened.

In this kind of atmosphere, the adversities are halved, as they say, and the rewards come to those who deserve them. When a group of engineers and designers at the turbine building plant was awarded a Ukrainian SSR State Prize, our department chief V.M. Kapinos was right there along with them.

Unfortunately, however, the alliance between the VUZ and industry is not everywhere as effective as it is with the turbine builders. And so the unrealized developments, whose urgency is unusually great, are still with us. And accelerating industrial reproduction and the VUZ scientific quest is a most topical problem. Sometimes expenditures of only kopecks can result in a saving of millions.

For example, PE-9131 electrical insulating varnish is being used successfully at the Leningrad Elektrosila Production Association. Two thousand tons of this varnish insures a saving of 1,000 tons of edible oil and almost R1.5 million of net profit.

The Lidskiy plant, however, where production of the varnish has been fully assimilated, is producing only 270 tons for Elektrosila. In 1983 the varnish was awarded a Sign of Quality. It would seem that all that was needed was to introduce it. However, not one of the electrotechnical enterprises in Kharkov has taken it up. You see, they say, the felt padding used to apply the coating must be replaced with rubber... The producers worry so much about the money that they fail to see the gold mines.

The special plastic composites developed by our chemists really are a panacea for many evils. They are irreplaceable in repairing some parts. And repair work can be done under any conditions--in small workshops or out at the field stations. Neither high temperatures nor superhigh pressures are required. The part is formed under ambient conditions. And the material possesses excellent physicochemical properties, combines easily with metals, is as good as steel parts in terms of wear resistance, and as good as bronze or brass. What a find for rural vehicle operators! But when we invite the Selkhoztekhnika specialists to our institute what happens? We'll look around, they say, feel the pulse of things. A voice crying in the wilderness! They just do not want it, and that is that...

We know the kind of attention that is now being paid to the struggle to conserve the water basins and the atmosphere. Specialists in the department of automation for chemical production have done their bit here also. The installation that they have developed for purifying exhausted lubricating and cooling fluids

using an electrochemical methods insures virtual 100-percent water purification. And the sludge that is removed can be used for greasing molds at ferroconcrete structure plants, thus saving kerosine.

The method has been awarded many certificates of invention and patents. But its introduction here is just like groping along. Even though practical work at the Serp i molot Plant confirms the reliability of the calculations and practical conclusions. Let's take it up, let's introduce it!

Scientific and technical progress is an irreversible process. The difficulties of the scientific quest are without end. When problems arise in production, science is today ready to get involved in solving them. But somehow a paradoxical situation has come about: a plant needs something, we seek it out together, we develop something, spending enormous amounts and considerable effort, and things progress toward introduction. And then the process is held up for years...

At the CPSU Central Committee June (1983) Plenum, comrade Yu.V. Andropov neatly encapsulated the problem: we must first of all bring good order to what we have and insure the most rational use of the country's production and scientific potential. This same thought was underlined at the CPSU Central Committee December (1983) Plenum; the Kharkov initiative is a direct response to this appeal. Our scientific potential is great and the return from it could be a hundred times greater. Now let us hear from the producers.

9642
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MINISTER DESCRIBES SOVIET SECTION AT MACHINE TOOL EXHIBITION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 27 Mar 84 p 2

[Interview with B. Bal'mont, USSR minister of the machine tool and tool building industry, by SOTSIALISTICHESKAYA INDUSTRIYA correspondent: "With Cutter and Laser"; place and date not specified]

> [Text] The international "Metalloobrabotka-84" exhibition opens today in Moscow. About 600 firms, enterprises and organizations from 22 countries and West Berlin are showing equipment, tools and instruments used to make articles from metal. In a conversation with our correspondent, B. Bal'mont, the USSR minister of the machine tool and tool building industry and chairman of the exhibition's organizing committee, talked about the aims and features of this exhibition.

Despite numerous predictions, metal remains the basic material of modern equipment. Accordingly, the processes involved in making articles from it form the basis of present-day machine tool production. The purpose of the "Metalloobrabotka-84" international exhibition is to offer a comprehensive review of the means--the equipment, tools and instruments--that make it possible to make these processes highly productive and flexible and insure high quality.

The leading role of machine tool building in the business of intensifying social production was emphasized at the 26th CPSU Congress. When dealing with this task during a speech to electors, the CPSU Central Committee general secretary comrade K.U. Chernenko noted that "It is absolutely essential for us to insure the rapid and uninterrupted renewal of all sectors of the national economy on the basis of the modern achievements of science and technology. This is a basic task for us. Without it, progress for society is simply inconceivable."

In order to carry out the task that has been set it is necessary to improve the mobility of machine building and its production and scientific and technical potential. In other words, machine toolmakers and their partners must provide equipment that combines a high level of automation and technological flexibility--the ability to switch to a new product rapidly and with minimal costs. This strategy in the development of machine building is embodied in the resetable

automatic lines, numerically controlled machine tools, "machining centers," standardized machine tool modules and flexible production systems being shown at the exhibition.

Among the 300-plus exhibits in the Soviet section, reflecting the efforts of 11 ministries, visitors' attention will surely be attracted by the multipurpose, NC machine tools developed by machine toolmakers in Ivanovo, Leningrad and Odessa. By reducing losses of time on auxiliary operations these machine tools make it possible to improve labor productivity by a factor of three to eight. The so-called flexible production modules are also arousing great interest. They are used in combination with NC machine tools and lathe equipment as an industrial robot that feeds parts for machining and then removes them, and devices that automatically change tools. If the module has to be reset for a new article all that has to be done is change a perforated tape program.

These modules can operate in automatic mode through two or even three shifts. They can be set up in automated sectors and lines and flexible production systems controlled by a common computer. Here, the computer "organizes" the operation of all the equipment, which significantly reduces the cycle for parts processing and improves quality. And at the same time, work conditions are improved. About 60 of these flexibile production systems are already in operation at enterprises in our country.

The desire to improve working conditions and free people from heavy and monotonous manual operations has been embodied in robotized machine tools and complexes and a whole range of program-controlled automatic manipulators. In particular, visitors to the Soviet section will be able to see a numercially controlled robotized lathe complex developed by machine toolmakers in Ryazan, and a lathe complex from the "Komsomolets" plant in Berdichev.

It is understandable that under the conditions of an exhibition it is not possible to show our most powerful automatic lines at life-size scales, as, for example, the unique metalworking units. But this equipment occupies a significant place in the total volume of machine tool output. One example is the lathes that make it possible to machine parts with diameters up to 6 meters and up to 32 meters long, and vertical turning lathes for machining parts with diameters up to 20 meters, and presses rated at 10,000 and 16,000 tons-force. One of these large lathes is being shown at the exhibition: it was made at the Tyazhstankogidropress plant in Novosibirsk and is designed for machining the support mountings for large marine engines. This lathe weights 500 tons.

Modern equipment using the latest electrophysicochemical processes is also being shown extensively at the exhibition. Speaking metaphorically, the traditional cutter here is replaced by machining facilities such as light from lasers, electric sparks, ultrasound and so forth. One example of this equipment is a light-beam lathe with program control, developed at the "ENIMS" [Experimental Scientific Research Institute of Metal Cutting Machine Tools] Scientific Production Association. It is designed for dimension processing of the most varied kinds of superhard materials, including diamonds and ceramics.

The pressing and casting equipment being shown in the Soviet section of the exhibition relfects one of the most important present-day trends, namely the course toward the introduction of low-waste and waste-free metal-saving technologies. Serviced by robots, this equipment is very productive.

Promising designs for tools are also broadly represented on the stands of the exhibition. They include tools made from new materials and with wear-resistant coatings. Our scientists and specialists have achieved considerable successes in the field of tool development. This can be seen, in particular, in the agreements and licensing contracts concluded with firms in the United States, England, Sweden, Italy, Japan, Finland and other countries.

The exhibition displays are graphic proof of the fruitful cooperation by machine toolmakers in the socialist countries. Thus, for example, thanks to the joint efforts of Soviet and Bulgarian specialists a semiautomatic NC circular grinding machine has been developed which can be organically combined in automated sectors. Specialists from the Ivanovo Machine Building Production Association and the GDR Fritz Heckert Combine have designed an up-to-date "machining center." Using technical documentation from "ENIMS" Czechoslovak colleagues have developed a second-generation industrial robot which was awarded a gold medal at the Brno International Fair. Series production of this robot has now been set up in Czechoslovakia and there are plans to deliver it to our country. Contacts are also being developed with firms in the capitalist countries.

By tradition, scientific-technical symposiums will be held within the framework of the "Metalloobrabotka-84" international exhibition. We are hopeful that the exchange of opinions and getting to know about the exhibit displays will serve to expand mutually advantageous cooperation and strengthen the cause of peace and mutual understanding between peoples.

9642
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SCIENTIFIC AND TECHNOLOGICAL PROGRESS: QUALITY, AMOUNT AND MEASURE

Moscow EKONOMICHESKIYE NAUKI in Russian No 1, Jan 84 pp 26-32

[Article by B. Smirnov, candidate of economic sciences]

[Text] The requirements to develop orderly socioeconomic theory of scientific and technological progress (STP) under socialism advance to the fore the task of methodological support of research in this field. And we are referring here not so much to refinement of some individual methods of analysis, calculation of indicators, etc., as to broad and constructive use of the entire aparatus of dialecticomaterialistic methodology in the process of learning about STP.

In accordance with materialistic dialectics, the first stage of construction of STP theory (as of any other phenomenon or process) should be analysis of its features, amount and measure, which are categories that disclose the specifics and basic distinctive signs of STP, its quantitative certainty and mechanism of measurement.

> These problems are specially discussed in only rare instances in the socioeconomic literature, and their interpretation varies substantially. Thus, V. G. Semibratov interprets quality of technological progress as the "aggregate of technical, economic and operating indicators, capacity to solve specific social problems, nature of relationship between engineering and science...."[1] V. Pavlyuchenko views the qualitative aspect of STP as development of "machinery, instruments, materials and technological processes based on fundamentally new ideas."[2] S. M. Yampol'skiy and V. G. Chirkov believe that qualitative evaluation of STP is expressed as saving of social labor and increase in its productivity.[3] There is a popular view to the effect that qualitative evaluation of STP includes determination of economic effectiveness of new equipment and its social results. At the same time, some authors believe that determination of socioeconomic effectiveness is a quantitative estimation of STP.
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> If we refer to the already cited works, we shall see that V. G. Semibratov relates this evaluation to the quantity of units of operating equipment, level of their output, diversity of areas of application, potential possibility of development of industry and

> science with their use. In the opinion of V. Pavlyuchenko, the quantitative changes in STP are related to refinement of traditional technology and fuller use of its capabilities. S. M. Yampol'skiy and V. G. Chirkov determine the quantitative aspect of STP through its scope and pace. There is also the view that qualitative evaluation of effectiveness of STP is not adequate, that it is approximate, while the quantitative one is precise and definite.[4]
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> The most varied parameters are proposed to measure the level of STP (from the level of technical armamentarium of labor to the socioeconomic effect of new equipment), the very concept of measure is often without its own content, and it is equated with either qualitative or quantitative characteristics of science, new equipment and technology. The existence of various approaches to qualitative, quantitative evaluation and measurement of STP intensifies the need to search for means of providing methodological unity in this matter.

We believe that *qualitative analysis* of STP should consist of determining its content, distinctions and place in the means of social production. The answers to these questions will serve as the basis for subsequent in-depth investigation of the patterns of development of science and technology under socialism.

There are quite a few approaches in the economic and philosophical literature to definition of the typical features and content of STP. In our opinion, the most correct one is to view STP as a historical category expressing the basic qualitative distinctions (features) of development of modern productive forces.

The *first feature of STP* is transformation of scientific endeavor into the required condition for development and operation of all elements of the production process. As a rule, this feature is characterized by both transformation of science into an immediate productive force and onset of priority of science over industry, although these processes are not always interpreted in the same way. Moreover, there are interpretations that are wrong in our opinion. For example, scientific knowledge and theory per se are often declared to be an immediate productive force. The fallaciousness of these statements lies in the fact that scientific work itself is equated with the tangible expression of its results in elements of productive forces. The latter, however, by no means alters the nature of science as a form of social consciousness, spiritualactivity of man, but merely characterizes appearance in it of a new function, brought to life by industry and fused with it, of obtaining scientific results of immediate practical relevance. The community of this function in science and industry generates its duality: it is both an industrial function of science and a scientific function of industry. Such duality objectively contains a specific contradiction between science and industry, investigation of which is a mandatory prerequisite for developing an effective mechanism for acceleration of STP.

The theses advanced by some authors about the dominant role of science in relation to industry does not take into consideration a conclusion that has been

confirmed by the experience of history: "... from the very beginning, inception and development of sciences were determined by industry."[5] The increasingly discrete and mediated mechanism of stimulating and regulatory effect of industrial needs in science under modern conditions cannot refute the thesis that "... economic need was and, as time passes, increasingly became the mainspring of progress in learning about nature."[6]

The question of priority in the relationship between science and industry is not only of theoretical, but great practical significance, primarily to define the center of concentration of the strongest sources and stimuli of STP in the structure of national industry. For example, having adopted the view that science has priority over industry, we should consider scientific research institutes and design offices as such a center. However, experience shows that the change of sectorial and even some academic scientific research organizations to a system of physical incentives in direct relation to the effect of their developments does not solve the basic problem of accelerating STP.

Many years of experience with this system in the electrical engineering industry, heavy, transport and energy machine building has shown, in spite of some achievements, that the problem of developing highly efficient new equipment and introduction of scientific developments in these sectors has not lost its acuity. A cardinal solution of this problem is possible only by establishing the main stimuli for accelerating STP at the enterprises proper, i.e., in the immediate area of production. It was noted at the 26th CPSU Congress that expressly industry "should be vitally concerned with faster and better assimilation of the results of the ideas and labor of scientists and designers."[7] Comrade Yu. V. Andropov indicated at the June (1983) Plenum of the CPSU Central Committe that "a system of organizational, economic and moral steps should be developed that would interest both administrators and workers, and of course scientists and designers, in renewal of equipment...."[8]

Thus, the first qualitative feature of STP discloses the patterns and forms of fusion of science and industry; it determines the priority of the latter in this process, demonstrates the practical needs for new scientific and engineering developments, for use of scientific achievements. On this basis, the concept of industry's scientific consumption is formed, the most promising forms of integration of scientific and industrial endeavor are developed, as well as the directions of development of science and technology; relevant forecasts are made and the variants of solutions to scientific and technological problems are defined.[9]

The *second feature of STP* consists of qualitative change, on the basis of innovations, of the relationship between man and the means of labor in the direct production process and growth, on this basis, of its results. This feature is expressed by the successive transfer of labor functions (at first physical, then a number of mental ones) from man to machine and by this virtue increased productivity of labor. At the same time, in our opinion the content of STP is by no means reduced merely to refinement of the material and physical basis of labor, as believed by some authors. Transformations in computer engineering and technology do not occur by themselves, by means of independent improvement, but ensues organically from the complex, dialectical interaction between man

and technical factors, from their capabilities, which are limited at each stage of STP, in solving new production problems. Thus, objectively one of the elements of STP is development of the work force, having workers acquire new knowledge and form new professional skills.

As we see, analysis of the second qualitative feature of STP discloses patterns related to change in the very nature of interaction between man and machines, with release of live labor by means of technical innovations, with development of the personality factor of production. We should include with these STP patterns the successive transmission of labor functions from man to machine, growth of technical structure of production objectively attributable to the change in stages of its mechanization and automation, distinctive features of engineering, technology and work force at each of these stages, etc.

The *third qualitative feature of STP* is characterized by its place in national production. At the present time, a separation between STP concepts and so-called basic industrial activities developed in science and practice. And, as a rule, STP is characterized as a special area of endeavor with its own specific stages, directions and patterns. In particular, the temporary destabilization of production and decline of indicators of enterprise performance are included among these patterns. Conversely, basic production is construed as the output of products according to plan using new production capacities, i.e., the stage of already organized production characterized by stability of indicators.

Apparently, with such differentiation, STP and basic production are artificially separated from one another, viewed as different processes. Yet, K. Marx had already remarked that modern industry is characterized expressly by constant revolutions in the technical basis of production.[10] Under conditions of developed socialism, STP acquires elements of a constant and principal factor of industrial work, its patterns become the deciding elements of development of national production, while efficacy of STP is the leading element in effectiveness of the national economy. Consideration of these patterns, orientation of management primarily toward the effect of STP constitute one of the first and foremost objectives of the science and practice of controlling socialist economy.

The observed qualitative features of STP enable us to define it as *a legitimate historical stage of development of productive forces, where all of their elements in the national production process emerge as the result of using progressive achievements of science, while scientific and technological work itself is a mandatory condition for replacing live labor with new equipment, constant renewal of production and growth of its efficiency on this basis.*

The importance of singling out and making a special study of the qualitative aspect of STP lies in the fact that it is expressly through it that development of modern productive forces affects the nature and content of society's economic relations. These relations are being tied in more and more closely with achievement of STP which, however, does not transform it into an economic category, as believed by a number of authors. Strictly speaking, the above qualitative distinctions of STP are the object investigated by history and theory of development of science and technology, productive forces as a whole.

Within the limits of economic sciences, however, analysis is made of the qualitative distinctions of economic form of STP, which includes elaboration of concepts of economic range of application of technology, organic structure of production, economic effect of innovations, its national economic and cost-accounting forms, determination of expenses for scientific research and experimental design work, assimilating new production, etc.

An important aspect of integrated investigation of STP is analysis of its social form, *social quality*, i.e., nature of influence of new equipment and technology on substance and conditions of labor, its social differentiation, class structure of society. This area also includes definition of tasks dealing with development of social (including moral) incentives for STP, social standards-requirements for innovations, mechanism of compensation for their social consequences of a negative nature.

Thus, analysis of qualitative distinctions of STP emerges as a mandatory stage in learning the patterns of development of science and technology under socialism. The result of this analysis is by no means approximate, but the exact knowledge of basic features and characteristics of STP, its content and place in national production, without which scientifically validated methods cannot be developed for its quantitative evaluation, measurement and acceleration.

Quantitative analysis plays an important part in studies of STP. Its objective is to determine, on the basis of mathematics, the concrete numerical values and trends of changes in the general and basic patterns and characteristics that were found in the course of qualitative analysis of STP: level and dynamics of science intensity of industry, its mechanization and automation, technical armamentarium of labor, share of new equipment and progressive technological processes, age structure of work tools, number and structure of research organizations, scientific and engineering workers, duration of "science-production" cycle, etc.

In the economic aspect, quantitative evaluation of STP is characterized by the following: organic structure of production; volume and structure of expenses for development of science, development and introduction of new equipment; extent of economic effect, increment in labor productivity and volume of production as a result of the innovations; proportion of expenses for live and embodied labor in manufacture of products, etc. In the social aspect, quantitative evaluation of STP could be expressed by the share of workers engaged in heavy, unskilled, monotonous labor deleterious to health, changes in social structure of society under the influence of technical refinement of production and other indicators.

Development of methods for quantitative expression of results of STP is a serious task. Here, the method of production function is often recommended; it expresses the relationship between volume and different combinations of production factors, among which investments, labor and technical progress are singled out. This function, which reflects indirectly one of the most important features of the latter--change in proportion of live and embodied labor--serves as a means of approximate evaluation of the influence of new equipment and technology on overall production indicators; it permits detection

and analysis of the various forms of STP: capital-intensive, capital-conserving and neutral.

At the same time, as properly believed by many specialists, use of the production function for quantitative description of STP is limited only to evaluation of its different directions and aspects. For example, in the function of R. Solou, technological progress is expressed as the age structure of fixed capital, its renewal. In the model of E. Denison, STP is evaluated on the basis of increase in quality of work force due to growth of educational and qualification aspects of the workers. E. Mansfield, in his critical assessment of the feasibility of using the production function and a number of other methods of factorial analysis for quantitative evaluation of STP, observed that with the use of these methods "economists are unable to single out the results of scientific and technological progress proper with, perhaps, exception of instances where he is dealing with individual production processes."[11] In our opinion, the reason for this is the approach used in these methods to evaluation of STP as a separate, independent factor of national production, the desire to define the contribution of science and technology to economic growth by means of analytical determination of their share. However, as correctly noted by A. I. Anchishkin, the distinction of STP "is that it cannot appear in its image in the course of production."[12] STP does not stand "next" to elements of the work process, but emerges in the form of more sophisticated means of labor, technology, work force, eliciting through them an increase in scale and efficiency of production. This enables us to concur with the Soviet and foreign economists who believe it unlikely that a precise determination of share of STP in economic growth can be made by using production function and methods of factor analysis.

> To estimate this share, some specialists try to find the share of intensive factors in end indicators of production, equating these factors with STP, with the qualitative characteristics of development of the economy. At the same time, extensive factors are not infrequently considered to be a quantitative characteristic of production that is not related to STP. Thus, N. K. Kul'bovskaya writes: "The indicators (of scientific and technological progress--B. S.) that are being advanced are referable essentially to characteristics of the intensive type of expanded reproduction. And this is fully justified. For expressly scientific and technological progress serves as the distinctive features, according to which two types of reproduction are distinguished."[13] In the opinion of K. Leykina, "unlike extensive development that is characterized by purely quantitative growth of resources of production on the former technical level, intensive development is characterized by qualitative changes in production factors, change of process of expanded reproduction to a new technical basis...."[14] The authors who adhere to this opinion often refer to the well-known thesis of K. Marx: "... reproduction occurs at certain intervals of time and, if considered from the social point of view, reproduction on an expanded scale: expanded extensively, if only the field of production is expanded and expanded intensively, if more efficient means of production are used."[15] However, this statement cannot, in our opinion, serve as the basis for equating

> extensive factors to quantitative ones and intensive factors to qualitative ones in the area of production. K. Marx interprets the concepts of "extensive" and "intensive" as various forms of quantitative expansion of production, or reproduction on an expanded scale.
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> At the same time, the difference between these two forms is not reduced to absence of STP attributes in one of them and presence in the other. In the first place, the greater efficiency of means of labor, about which K. Marx writes as a sign of intensification, depends on at least two circumstances: a) on the technical sophistication of work tools, degree of their planned productivity, which is directly related to STP: b) on extent of utilization of these means, which is determined mainly by organizational and economic factors. In the second place, extensive expansion of different elements of national production is directly related to scientific and technological progress, to intensification of the national economy. This refers, for example, to growth in number of scientific research institutes, design offices, experimental testing enterprises, scientific production associations and employees working there, increase in expenditures for development and introduction of new equipment, etc.

Quantitative analysis together with qualitative is an important methodological principle of studying STP. This can be seen on the example of structural policies in the area of work tools, the purpose of which is planned build-up of their production with due consideration of the achieved level, efficiency and socioeconomic conditions of their use. Thus, analysis shows that, at the present time, when a considerable share of workers in the national economy is still engaged in manual labor, mechanization of production is found in many cases to be more effective (from the standpoint of both expenses and release of workers) than automation. Under these conditions it is hardly expedient to accelerate production of automatic equipment, including robots, in all cases.

In addition to this, the structural policy should take into greater consideration the socioeconomic conditions of equipment use. This requirement is particularly timely now for sectors that produce machinery for agriculture, where there are personal subsidiary farms along with large national production. Fulfillment of the USSR Food Program implies fuller use of the former's capabilities in providing the public with foodstuffs. For this reason, it is necessary to produce not only equipment with high unit capacity, but small-scale mechanization equipment use of which in personal farms yields a high return, as shown by the knowhow of several socialist countries. A quantitative evaluation, however, which shows for example the increase in share of technically progressive, large-scale equipment, cannot indicate fully enough the national economic effectiveness of structural changes in the production of farm machinery.

Investigation of its *measure* holds a special place in analysis of STP. "Determination of measure of phenomena and processes is, on the one hand, synthesis of data from qualitative and quantitative analysis and, on the other hand, a

special study of specific forms of phenomena, their limits and "extreme" states, opportunity for development with the limits of a given quality, combination of qualities, subordination of substantive and systemic qualities, etc."[16] Qualitative, quantitative and measurement analysis are interrelated, but at the same time each has its own specific and relative autonomy. Overlooking this circumstance sometimes leads to replacement of analysis of measure of STP with either qualitative or quantitative characteristics. Nor can one consider it sufficiently justified to try to define some autonomous measure of STP without regard for the main indicators of management and such elements of management as the system of prices, formation of profit, etc., which serve to measure and control the level of development of industry. The methods of measuring STP proposed by several authors, which are based on factor analysis of its results (for example, influence of equipment, technology, work force on effectiveness of production)[17] can only be of limited relevance to practice, due to their arbitrary nature, complexity and, mainly, absence of organic link with existing methods of economic measurements contained in the management mechanism.

The measure of STP is a complicated, multi-aspect concept. It is the synthesis of concrete qualitative and quantitative parameters of individual scientific achievements; it reflects the advanced (worldwide or domestic) level of development of productive forces in the form of diverse scientific and technical characteristics and indicators. The degree of conformity to this level serves as a criterion for evaluating results obtained in each area of science and engineering. This is how determination is made of the degree of novelty of scientific and technical knowledge, the status of discoveries or inventions is found for them, measurement and certification are effected for the technical level of production, technology and means of labor. At the same time, this direct measure of STP is a means of evaluating only its different elements according to their scientific and technical level, but cannot be used as an overall criterion for evaluation of STP as a whole, both at an enterprise and in the sector, or in the entire national economy. Suggestions to measure STP by determining the so-called scientific and technical potential of enterprises, scientific-technical and organizational-technical level of production, etc., followed by comparison of its levels at different enterprises could hardly be justified.[18] Various indexes and scores are proposed for such ratings and comparisons (in view of the absence of a common measurement unit). However, the arbitrariness of indexes and scores makes it impossible to use them as criteria and regulators of STP in the management system which, in our opinion, is the reason for absence to this time of a general industrial standard method for combined measurement of the economic-technical level of production.

In our opinion, the above-mentioned approach is based on overestimation of the role of scientific-technical criteria proper in measurement of STP, the idea of feasibility of determining its general measure regardless of other criteria, primarily the economic one. However, expressly the latter provides for a single rating scale; it is a universal measure of STP and emerges in the form of its economic effectiveness.

Objectively, there are several forms of such a measure according to levels of the national economy. First of all, there is the local measure of STP, or

effectiveness (for example, profitability) of development and introduction of new equipment, from the standpoint of the interests of a particular cost-accounting enterprise. The distinctive feature of this form of measure is that it can also reveal a negative effect, since even very promising innovations often lead to decline of cost-accounting effectiveness of an enterprise at the first stage. The concrete result of STP at an enterprise is not rated on its own, but from the standpoint of all of society. The local measure of STP acquires a new characteristic through its social measure (norm) of effectiveness, just like individual expenses on manufacture of a product have a higher measure in socially necessary labor expenditures. Thus we find the principal form of STP measure on the level of the national economy as a whole, the socially necessary level (or norm) of its national economic effectiveness, which developed under the influence of the achieved level of effectiveness of national production, prospects of raising it under the influence of development of science and technology, level of prices, wages and limit of resources. This social norm should be used as a measure to assess innovations and basis for their planned selection.

The last stage of analysis of measure of STP is to determine the national economic measure, which emerges in so-called real converted forms. Passing through the prism of the entire aggregate of concrete socioeconomic relations and categories of socialism, existing ways and means of management, the national economic measurement of effectiveness of STP is manifested by such real categories as price, profit, profitability, national income, etc. In particular, by means of price that reflects the movement of socially necessary expenses for labor and its savings as a result of introducing new equipment, the national economic effect of STP is expressed as an increase in profit, profitability, in net production at enterprises and, ultimately, increment of national income, the aggregate national product, effectiveness of national labor. Thus, determination of effective measure of STP can be done by means of validated estimates of its economic effectiveness and its fullest reflection in elements of the management system.

The measure of STP, which is under the deciding influence of the basic economic law of socialism, has not only an economic, but social content, which means that in selecting variants of new equipment and technology one must take into consideration such factors as improvement of the substance and conditions of labor, lowering the share of heavy jobs that are deleterious to man's health, preservation of the environment, etc. Reflection of all these factors in an evaluation of effectiveness of STP is an important direction of refining the system for measuring it.

FOOTNOTES

1. Semibratov, V. G., "Dialectical Patterns of Technological Progress," Leningrad, 1971, p 78.

2. Pavlyuchenko, V., "Quantitative and Qualitative changes in Scientific and Technological Progress," VOPROSY EKONOMIKI, 1970, p 23.

3. See: Yampol'skiy, S. M. and Chirkov, V. G., "Problems of Measurement and Analysis of Scientific and Technological Progress," Kiev, 1971, p 4.

4. See: "Economic Theory of Scientific and Technological Progress," Moscow, 1982, pp 147-148.

5. Marx, K. and Engels, F., "Works," 2d ed., Vol 20, p 500.

6. Idem, Ibid, Vol 37, p 419.

7. "Proceedings of 26th CPSU Congress," Moscow, 1981, p 43.

8. "Proceedings of Plenum of CPSU Central Committee on 14-15 June 1983," Moscow, 1983, pp 10-11.

9. Qualitative analysis of STP also includes the concept of "new equipment" that refers at this stage of investigation the novelty of equipment only from the standpoint of its engineering principles, design and technological distinctions, etc. Going ahead, let us note that the quantitative parameters of new equipment (output, durability, reliability, etc.) are found in the course of quantitative anlysis of STP. In examining its measure, we find the novelty of consumer cost of equipment, i.e., its ability to meet new demands or to satisfy in a new way already existing demands.

10. See: Marx, K. and Engels, F., "Works," 2d ed., Vol 23, pp 497-498.

11. Mansfield, E., "Economics of Scientific and Technological Progress," Moscow, 1970, p 44.

12. Anchishkin, A. I., "Forecasting Growth of Socialist Economy," Moscow, 1973, p 57.

13. Kul'bovskaya, N. K., "Forecasting and Measurement of Scientific and Technological Progress," Moscow, 1976, p 65.

14. "Economics Encyclopedia. Political Economy," Moscow, Vol 2, 1975, p 38.

15. Marx, K. and Engels, F., "Works," 2d ed., Vol 23, p 193.

16. "History of Marxist Dialectics. From Inception of Marxism to Leninist Stage," Moscow, 1971, pp 172-173.

17. See, for example: Golosovskiy, S. I. and Grinchel', B. M., "Measurement of Influence of Scientific and Technological Progress on Effectiveness of National Production," Moscow, 1982.

18. See, for example: "Measurement of Scientific and Technological Progress of Enterprises and Associations," Leningrad, 1980, p 10.

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RAPID DEVELOPMENT OF SPEECH SYNTHESIZER REPORTED

Moscow PRAVDA in Russian 13 Feb 84 p 3

[Article by PRAVDA correspondent I. Novikov: "The Machine Learns To Listen"]

[Text] The Kaliningrad Experimental Mechanical Plant has started up series production of the "MARS" (multiprogram speech recognition and synthesis apparatus) speech analyzer and synthesizer, developed by scientific associates at the All-Union Scientific Research Institute of Communications. The first batch is being prepared for production.

PRAVDA has already written about an instrument that inputs human speech to a computer. This was a speech synthesizer--a phoneme recorder [fonemofon] that reproduces the human voice. The operator was able to "teach" the machine to pronounce enough words for the computer to be able to interact with a human operator. Tasks were inputted via a keyboard, in written form, and the machine responded by saying the word.

This device considerably simplified the use of the computer. Data could be retrieved from it much faster. The advantages were immediately recognized by many managers and scientists. The phoneme recorders were acquired by the USSR Academy of Sciences Institute of Nuclear Research, the Leningrad Fire Fighting Administration, the Voronezh Polytechnical Institute and many other organizations and institutions.

The scientists and producers continued the creative quest. They set themselves the tasks of teaching a computer to hear. Thus, the "MARS" was developed. G. Kalinin, chief of the programming laboratory at the Kaliningrad Experimental Mechanical Plant, demonstrates the operation of a computer that is using the listening device. This complex is operational in the plate-spraying section in one of the shops in this plant. Gennadiy Borisovich switched on the apparatus and a voice reported: "Ready for unit control. Which mode?"

"Manual," Kalinin replied.

A row of lamps lit up. Kalinin ordered "Commence algorithm."

In response, "MARS" said that the operator was feeding nitrogen. And when his need was complete, it reported: "Nitrogen flowing. Load plates."

The loading process was completed. Kalinin spoke into the microphone, reporting that the plates had been fed in.

Several times Kalinin asked the machine "What are you doing?"

"MARS" reported that it was scavenging. The operator wanted to know the pressure in the chamber. The machine answered that pressure was poor, and continued to scavenge the air. And when the required regime had been established, spraying of the plates started.

The man and the machine interacted right through to the end of the entire technological operation. They carried out the production process as equals, insuring high product quality.

This is only one example of the practical use of "MARS." In the words of A. Yeremin, chief engineer in the design bureau at the Kaliningrad Experimental Mechanical Plant, it is difficult to name a sector or a kind of production where it would not be possible to use a computer with a voice dialog facility. "MARS" is particularly promising in machine design. Up to now designers have made little use of computers because working with a display unit was difficult. Now the voice can be used to order the computer to carry out any operation connected with design work.

"From the idea to series production has taken only 3 months," says V. Afanas'yev, a design bureau section chief at the Kaliningrad Experimental Mechanical Plant. "This has been possible thanks to the close business contacts with the scientists. We think that success in realizing any scientific idea depends first and foremost on this kind of mutual understanding between scientists and producers."

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ACADEMICIAN DISCUSSES GRADUATE SCHOOL TRAINING IN SCIENCES

Moscow LITERATURNAYA GAZETA in Russian 7 Mar 84 p 10

[Letter to the editor by Academician V. Ginzburg: "Must Authors of Dissertations Be Disturbed?"]

[Text] In the course of several decades, before the war and especially after its conclusion, the number of scientists increased rapidly in the USSR. Quite a long time ago this number already exceeded 1 million. Since the rate of the corresponding increase far exceeded the rate of growth of the population and a number of national economic indicators, a certain "saturation" should inevitably have set in, and it has already set in in part. Saturation is appearing, in particular, in the fact that it is not easy to provide all doctors and candidates of sciences with official positions which correspond to their skills. The role of graduate studies has also changed substantially, a number of new problems have arisen. And it would be incorrect to remain silent and wait until "everything comes into being by itself." Therefore I am making an attempt here to attract attention to several, be they even not the most important, but urgent questions which are connected with the development of science in the country.

The noted effect of saturation is appearing if only in the fact that doctors of sciences, who previously could count with confidence on positions of a senior scientific associate or a professor, now at a number of institutes and higher educational institutions are deprived of such an opportunity--there are not enough vacancies. I am not really talking about candidates of sciences--at academic institutes they more and more often remain in the position of junior scientific associates with a degree. Some of them are in such a position until retirement.

Incidentally, the entirely sound suggestion also to introduce the position (and, if necessary, the title) "scientist" without the prefix "junior" has already been advanced more than once.* But even such a simple step is simply not being taken. As justification of inaction I have heard the argument: it is

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* See, in particular, the articles of Academicians I. Gerasimov, D. Likhachev, F. Chukhrov and other scientists in the selection of materials "The Junior Scientific Associate: The Name and Essence" (LITERATURNAYA GAZETA, No 26, 1977)--editor's note.

necessary to "streamline" the wage of scientists, it is when this happens that we will also change the title. Indeed, this step became ripe long ago, but why tie one without fail to the other?

Unfortunately, I do not know of any steps in this direction, but here the opposite trend has obviously appeared--now here, now there they are beginning to hinder the defense of dissertations. The justification is like this, for example: at the institute (higher educational institution) there are no longer vacant positions of senior scientific associates (docents, professors), why should a junior scientific associate (lecturer) defend a doctoral dissertation? If you want to defend it, look for a different job, while it is impossible to remain, when one is a doctor, in the position of a lecturer or junior scientific associate. I am convinced that such a trend is incorrect from all points of view.

The publication of articles and the defense of dissertations are the basic and often the only forms, in which a scientist can demonstrate his scientific results and show his skills. To hinder the publication of articles and defenses (on the condition that the high quality of the work does not arouse doubts) means to inflict moral injury on a person and to deprive him of his legal rights.

The official position is something entirely different. If, say, a doctor of sciences prefers to remain a junior scientific associate or a lecturer at a good (from his point of view) institution, and not to move to another city or to transfer to a different institution to a higher position, that is his business. Moreover, undoubtedly, the appearance of a significant number of doctors of sciences, who hold "low" positions, will create the "bank," from which candidates for the filling of vacant positions of a higher rank at various institutes will be drawn.

With respect to dissertations for candidate degrees, a "crisis," as far as I know, has not yet come. Meanwhile the more candidates (of course, who are worthy of this degree) there are, the better. For example, is it really not advisable to use them at schools and tekhnikums? For this it is necessary only to create the appropriate conditions.

Thus, the defense of dissertations should be entirely free of all obstacles of an administrative nature. As to the demands on the quality of the dissertations, one must not, of course, decrease them, but it is also impossible to increase them (if one is speaking about the instructions of the Higher Certification Commission). Suffice it to say that in accordance with these instructions a doctoral dissertation should be "...a work, in which on the basis of the research performed by the author scientific assumptions, the set of which can be qualified as a new promising direction in the corresponding field of science, have been formulated and substantiated, or the theoretical generalization and solution of a major scientific problem, which is of great national economic... and sociocultural importance, have been carried out." I consider such requirements, as a rule, to be unrealistic and undue. But this is the topic of another discussion.

The situation, which now exists at scientific institutes and higher educational institutions, has led, as was already mentioned at the beginning, to the

radical change of the place and role of graduate studies. The question of graduate studies is diverse. The approach to it should depend on the field of science and a number of conditions. I will confine myself here to remarks on graduate studies of the USSR Academy of Sciences. They are small. For example, at the FIAN--the Physics Institute imeni P. N. Lebedev of the USSR Academy of Sciences--there are now 18 graduate students of the "basic" graduate studies and 25 so-called special graduate students. The latter have been sent from other institutions and should, according to the idea, return there on completion of graduate studies. Special graduate studies are in principle a good cause, but the lack of competition and a number of other circumstances greatly depreciate them. The main thing is that graduate studies at the Academy of Sciences, even with allowance made for special graduate studies, are very small as compared with the available possibilities. Thus, more than 100 doctors of sciences (including academicians and corresponding members of the USSR Academy of Sciences) now work at the FIAN. Thus, there are more than five doctors of sciences per "basic" graduate student. In the Theoretical Physics Division imeni I. Ye. Tamm of the FIAN there are now only 3 basic and 3 special graduate students for 22 doctors of sciences. But up to 30-40 graduate students, I believe, could be profitable both for the division (the graduate students perform scientific work) and for the business of training personnel.

What are the reasons for such a situation? For admission to basic graduate studies the division and the institute as a whole should from the very start guarantee the job placement of the graduate student. A person is to spend 3 years in graduate studies, how he will show himself is still unknown, but it is already necessary to ready a position for him! This automatically greatly limits the number of vacancies for graduate students, as well as hinders the assignment of the graduate students, who are finished, to other institutions. No special aspiration to get hold of academic graduate students outside the academy is being observed. This at first glance may seem strange, but in reality is entirely understandable. It is well known that the academic graduate studies are small and there is no special competition for them. Moreover, the academy keeps the best people for itself: those, who are suggested "for export," may turn out not to be stronger than those available at the given nonacademic institution. But here the question of living space and so on and so forth may still arise.

Thus, the academy trains the "basic" graduate students mainly for itself, for the few vacant positions. But if these positions exist, in most instances graduate studies also are not at all necessary. What difference is it, if a young person enters graduate studies or the position of a junior scientific associate without a degree, an engineer or a laboratory assistant? At least for a large number of specialties there is no difference here. Only the graduate student should submit a dissertation after 3 years, otherwise there will be "the nonfulfillment of the plan." The associate can work on the dissertation longer, from which the work will by no means suffer.

It would not be worth writing about all this, if academic graduate studies actually were not necessary. On the contrary, they are very necessary, but of a different type (I have already written about this in the newspaper IZVESTIYA of 8 September 1976).

The tasks facing science are enormous and are not decreasing, and more and more often it is necessary to accomplish them not by number, but by ability. The latter, in particular, implies that it is necessary to seek brilliant people, to select people, who are most capable for the given occupation, and to help them. Precisely the USSR Academy of Sciences can and should select and train in graduate studies young people for a number of specialties, which are well represented at the academy (physics, mathematics, chemistry, biology and others). The corresponding academic graduate student body should be made up by an extensive (all-union) open competition. And, of course, only a small portion of those who have competed graduate studies will be able to remain at the USSR Academy of Sciences itself.

Undoubtedly, the organization of such graduate studies is a difficult matter, and, in particular, it involves the elimination of graduate studies at institutions, at which there are comparatively few highly skilled specialists. But it is necessary to remember that for the training of a modern specialist who is a candidate of sciences, so that he could reveal his abilities as extensively as possible, the appropriate environment (scientific seminars and discussions, sufficiently many colleagues) is necessary, a first-rate library and so on is necessary. All this is available far from everywhere.

The training of the most highly skilled scientific personnel for the entire country along with the assurance of the proper level of research on the fundamental problems of science--precisely these are the basic directions, on which the activity of the USSR Academy of Sciences should be concentrated.

> In our opinion, important problems are raised in the letter of Academician V. Ginzburg. We ask our readers to express their opinion on the questions touched upon by the scientists and, in particular, to express their opinion on whether it is advisable to "check" the increase of the number of "degreed" scientists in the absence at a given scientific institution of the corresponding "vacancies."

Science Department of LITERATURNAYA GAZETA

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1984 LENIN PRIZES IN SCIENCE AND TECHNOLOGY AWARDED

Moscow IZVESTIYA in Russian 22 Apr 84 pp 1-3

(Decree of the Central Committee CPSU and Council of Ministers USSR "On the Awarding of Lenin Prizes for 1984 in the Field of Science and Technology")

[Test] Having reviewed the recommendation of the Committee on Lenin and State Prizes USSR in the field of science and technology under the Council of Ministers USSR, the Central Committee CPSU and Council of Ministers USSR decree:

to award the Lenin Prizes for 1984 in the field of science and technology to:

1. Vasil'yev, German Konstantinovich, doctor of physicomathematical sciences, laboratory head at the Institute of Chemical Physics, Academy of Sciences USSR: Tal'roze, Viktor L'vovich, corresponding member of the Academy of Sciences USSR, deputy director of the same institute; Orayevskiy, Anatoliy Nikolayevich, doctor of physicomathematical sciences, department head at the Physics Institute imeni P. N. Lebedev of the Academy of Sciences USSR: Markin, Yevgeniy Pavlovich, candidate of physicomathematical sciences, senior scientific associate of the same institute, - for the cycle of works "Fundamental Research of Chemical Lasers in Chain Reactions," published from 1963-1978.

2. Kadomstsev, Boris Borisovich, academician, director of a branch at the Institute of Atomic Energy imeni I. V. Kurchatov; Shafranov, Vitaliy Dmitriyevich, corresponding member of the Academy of Sciences USSR, department head; Pogutse, Oleg Pavlovich, doctor of physicomathematical sciences, laboratory head, and to his associates of the same institute: Sagdeyev, Roal'd Zinnurovich, academician, director of the Institute of Cosmic Research of the Academy of Sciences; Galeyev, Al'bert Abubakirovich, doctor of physicomathematical sciences, department head of the same institute; Kovrizhnykh, Lev Mikhaylovich, doctor of physicomathematical sciences, laboratory head at the Institute of General Physics of the Academy of Sciences USSR - for the cycle of works "Theory of Thermonuclear Toroidal Plasma" published from 1959-1980.

3. Dolgoplosk, Boris Aleksandrovich, academician, laboratory head at the Institute of Petrochemical Synthesis imeni A. V. Topchiyev of the Academy of Sciences USSR: Tinyakova, Yelena Ivanovna, doctor of chemical sciences, senior scientific associate of the same institute, - for the cycle of works "Metallorganic Catalysis in the Processes of Polymerization" published from 1969-1982.

4. Reutov, Oleg Aleksandrovich, academician, department head at Moscow State University imeni M. V. Lomonosov - for the cycle of works "Research in the Field of Metallorganic Chemistry of Nontransitional Metals" published from 1953-1982.

5. Rapoport, Iosif Abramovich, corresponding member of the Academy of Sciences USSR, department head at the Institute of Chemical Physics of the Academy of Sciences USSR - for the cycle of works "Phenomenon of Chemical Mutagenesis and Its Genetic Study."

6. Yanin, Valentin Lavrent'yevich, corresponding member of the Academy of Sciences USSR, department head at Moscow State University imeni M. V. Lomonosov; Kolchin, Boris Aleksandrovich, doctor of historical sciences - for the cycle of works "Historical-Archeological Research of Novgorod" published from 1978-1982.

7. Kazakov, Nikolay Fedotovich, doctor of technical sciences, department head at Moscow Aviation Technological Institute imeni K. E. Tsiolkovskiy, project supervisor; Lakin, Nikolay Aleksandrovich, senior engineer of the same institute; Artemov, Nikolay Stepanovich, candidate of technical sciences, director of the Tambov Plant of Chemical Machinebuilding "Komsomolets;" Kotyurgin, Yevgeniy Alekseyevich, candidate of technical sciences, department head of the scientific-research institute; Malevskiy, Iosif Boleslavovich; Kharchenko, Gennadiy Konstantinovich, candidate of technical sciences, laboratory head at the Institute of Electric Welding imeni Ye. O. Paton of the Academy of Sciences of the Ukrainian SSR - for development and widespread introduction into production of diffusion welding of metallic and nonmetallic materials.

Secretary of the
Central Committee USSR
K. Chernenko

Chairman of the Council
of Ministers
N. Tikhonov

CSO: 1814/150

UKRAINIAN SCIENTIFIC AWARDS LISTED

Kiev PRAVDA UKRAINY in Russian 28 Mar 84 p 3

[Interview with academician I.K. Pokhodnya, vice president of the Ukrainian SSR Academy of Sciences: "Awards for Scientists"]

> [Text] On 30 March the annual general meeting of the UkSSR Academy of Sciences will open in Kiev. By tradition at one of the sessions diplomas will be presented to outstanding scientists in the Ukraine. PRAVDA UKRAINY asked UkSSR Academy of Sciences academician I.K. Pokhodnya, vice-president of the UkSSR Academy of Sciences, to give our readers some idea of the work that has been awarded prizes.

The new laureates include scientists from the academy institutes, the VUZ's, the sector scientific research institutes and other organizations, says Igor' Konstantinovich. One typical feature of the scientific work awarded prizes is the harmonious unity between deep basic problems solved by the researchers and the search for the most topical points of practical application for the findings in industry, agriculture, construction, public health and the other spheres of our lives.

Academicians of the UkSSR Academy of Sciences V.S. Mikhalevich and I.N. Kovalenko have been awarded the V.M. Glushkov prize for their cycle of work "Mathematical Methods for Analyzing and Optimizing Complex Systems." The analytical-statistical research methods proposed by these researchers have made it possible to enhance effectiveness in the development and study of high-reliability systems in modern technology.

The diplomas for the winners of the S.A. Lebedev prize will be awarded to the developers of a new class of computing equipment with apparatus for carrying out complex mathematical operations. These are doctors of technical sciences V.F. Yevdokimov, S.B. Pogrebinskiy and M.V. Sin'kov. The theoretical bases and methods developed by these scientists on the basis of the research conducted have led to the development of highly productive problem-oriented computing complexes.

The A.N. Dinnik prize has been awarded to academician of the UkSSR Academy of Sciences A.F. Ulitko and doctors of physicomathematical sciences V.T. Grinchenko and Yu.N. Nemish for their cycle of work "Accurate and Approximation Methods in Solving Three-Dimensional Problems in the Theory of Elasticity." This work is not only of scientific but also great practical significance.

Theoretical problems extremely important for practical work have become accessible thanks to new methods for solving systems of differential equations in statistical mechanics and mathematical physics. These methods have been developed by doctors of physicomathematical sciences Ye.D. Belokolos, D.Ya. Petrina and A.M. Kurbatov. These scientists have been awarded the N.M. Krylov prize.

The K.D. Sidel'nikov prize has been awarded to the authors of a monograph entitled "Electroreflection of Light in Semiconductors" by doctor of chemical sciences V.A. Tyagay (posthumously) and corresponding member of the UkSSR Academy of Sciences O.V. Snitko. Their book generalizes results from physics research that is of both fundamental and applied importance.

A large complex of basic and applied problems is covered in the monograph "The Isotopic Geology of the Ukraine." Research findings are being used extensively for dating the age of minerals. The authors of the monogrpah, candidate of chemical sciences Ye.N. Bartnitskiy and candidate of geological-mineralogical sciences I.P. Lugovaya are the winners of the V.I. Vernadskiy prize.

The results of research conducted by doctor of technical sciences L.A. Poznyak and candidates of technical sciences Yu.M. Skrinchenko and S.I. Tishayev have been embodied in new kinds of high-strength tool steels. The saving in the national economy has amounted to about R6 million annually. These scientists have been awarded the Ye.O. Paton prize.

The G.F. Proskura prize has been awarded for work on modeling heat fields in power engineering conducted by corresponding member of the UkSSR Academy of Sciences Yu.M. Matsevityy and doctors of technical sciences A.F. Verlan' and G.A. Sokolovskiy. On the basis of their fundamental studies mathematical and experimental methods have been proposed for designing powerful up-to-date heat machines.

For their research aimed at substantiating physicochemical methods in environmental protection and monitoring academician of the UkSSR Academy of Sciences A.T. Pilipenko, corresponding member of the UkSSR Academy of Sciences V.M. Vlasenko, and doctor of chemical sciences M.M. Tananayko are to be awarded the L.V. Pisarzhevskiy prize.

The A.A. Bogomolets prize has been awarded for a cycle of work "Pathophysiological Mechanisms in Organ-Specific Cytotoxic Serums" completed by doctor of biological sciences I.N. Alekseyeva and candidate of medical sciences T.M. Zelenskaya. The practical application of their work is found in medicine and animal husbandry.

Many urgent questions of great theoretical and applied significance are reflected in the monograph "Sporulating Aerobic Bacteria as Producers of Biologically

Active Substances." This basic research has formed the basis of a number of practical developments oriented on the needs of medicine and certain other sectors. The authors of this monograph, corresponding member of the UkSSR Academy of Sciences V.V. Smirnov, candidate of medical sciences S.R. Reznik, and candidate of biological sciences I.A. Vasilevskaya have been awarded the D.K. Zabolotnyy prize.

Corresponding member of the UkSSR Academy of Sciences G.V. Troitskiy and doctor of biological sciences A.P. Demchenko have been awarded the A.V. Palladin prize for research devoted to a study of protein structures. Promising spheres of application include the diagnosis of a number of diseases, the making of valuable biological preparations and so forth.

Candidates of biological sciences R.F. Protsko, V.B. Varshavskaya and Ye.K. Beletskaya have conducted work on the physiological bases of resistance in the most important agricultural crops during the process of vegetation and yield retention, and they are the winners of the N.G. Kholodnyy prize.

Research conducted by doctor of agricultural sciences M.Yu. Gushchin and candidate of agricultural sciences A.G. Usov has culminated in the creation of new varieties of apple, sweet cherry, peach, apricot and other fruits and berries. Some of them have already been regionalized. This work has been awarded the L.P. Simirenko prize.

The diploma of the V.Ya. Yur'yev prize will be presented to corresponding member of the UkSSR Academy of Sciences V.D. Romanenko for the development of ecological-physiological bases for warm-water pisciculture.

Current socioeconomic problems in improving efficiency in agricultural production and developing agro-industrial complexes have been comprehensively analyzed in work by doctors of economic sciences P.F. Vedenichev, A.M. Onishchenko and L.A. Shepot'ko, who have been awarded the A.G. Shlikhter prize.

The D.Z. Manuil'skiy prize has been awarded to doctor of historical sciences A.V. Santsevich for a monograph on the historiography and historical sources in the history of the Ukrainian SSR.

The I.Ya. Franko prize has been awarded for scientific work done by doctor of art criticism P.N. Zholtovskiy dealing with problems in the development of Ukrainian art and culture during the 16th through 18th centuries.

I would like to warmly congratulate the winners, I.K. Pokhodnya said in conclusion, and wish them new creative successes and further active participation in the day-to-day scientific quest.

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LATVIAN OFFICIAL DISCUSSES STATE STANDARDS AND TECHNICAL PROGRESS

Riga SOVETSKAYA LATVIYA in Russian 15 Dec 83 p 2

[LATINFORM interview with O.I. Malashenk, deputy chairman of the Latvian administration for state standards, by SOVETSKAYA RIGA correspondent: "The State Standards and Technical Progress"; data and place not specified]

[Text] In the recently promulgated CPSU Central Committee and USSR Council of Ministers decree "On Measures To Accelerate Scientific and Technical Progress in the National Economy" much attention was devoted to questions concerning the link between science and production, the production of output meeting the standards of today's best products, and the assimilation of new output and the withdrawal of obsolete products. Workers in technical control play a major role in solving these questions.

Our correspondent asked O.I. Malashenk, deputy chairman of the Latvian republic administration for state standards, to tell us how the technical control services are reviewing their work in the light of this party and government decree.

[Answer] The state system of standardization has recently undergone considerable changes. Comprehensive programs are being introduced in the various sectors in the country. They are insuring optimal requirements in the technical level and quality of products, raw materials, materials, and subassemblies, and also the means of production and control.

The general technical state standards are being successfully applied, as for example, the unified system of technological preparation for production, labor safety standards, quality control and so forth. However, the interests of the matter require a marked cutback in lead times for the introduction of scientific and technical developments in production. This complex task can be largely solved by so-called preferential standardization, where long-term requirements are established for a group of similar articles that should correspond to the best world products.

Long-term standards offer definite advantages, and when products are certified the requirements of the highest category of quality will already be embodied

in them. From 1984 a new procedure is being introduced for certification according to two categories of quality, namely highest quality and first quality. Articles that do not correspond to these two categories may be withdrawn from production.

The emphasis will be laid on the responsibility of the state certification commission for objectivity in evaluating the technical-economic level of output.

Great significance is attached to the organization of testing for articles. All-around support can provide the answer to the question of their reliability, durability and soundness.

[Question] What is being done in our republic to improve product quality?

[Answer] Virtually all industrial associations and enterprises, and also about 100 organizations in the nonindustrial sphere have completed the compilation and introduction of comprehensive systems for quality control and are perfecting them on the basis of a republic program.

Our republic system of product quality control was the first to be registered with the USSR State Committee for Standards. In the final stage, sector quality control systems will be drawn up and introduced in all industrial ministries and administrations, and in some of them they have already been introduced and registered. Territorial quality control systems are operating in Daugavpils and in the Leningradskiy and Leninskiy rayons of Riga.

More than 500 state standards and about 50 CEMA standards have been introduced in the republic. A review of republic standards and technical conditions has been completed and confirmed through 1989. Indicators, norms and requirements aimed at reducing material expenditures, reducing fuel and energy expenditures and improving standardization and reliability have been introduced in 80 percent of the normativ-technical documents reviewed.

The state metrology service has been further developed. The material base for corresponding equipment has been extended at the enterprises and in the Latvian Center for Standardization and Metrology. A republic base is being created for product testing.

[Question] Are we confident that these measures will create a solid barrier against spoilage?

[Answer] Much remains to be done in order to further improve quality. Analysis of results from a random check on the observance of technical conditions and metrologic backup for production conducted by the administration for state standards during the first half of the year shows that the number of enterprises operating in violation of the requirements of the state standards is still great. Whereas in the first half of 1982 some 60 percent of the enterprises checked had been violating these requirements, during the same period this year the number of such enterprises decreased only 2 percent.

Many articles are being produced in violation of the requirements of normativ-technical documentation. During the first 9 months of the year substandard output worth several million rubles was excluded from the accountability figures on marketing plan fulfillment. It includes articles from enterprises like the Riga Electromechanical Plant, the Yelgava Meat Combine, the Aldaris, Rigas tekstils and Sarkanais rits associations, and others. Sanctions have been applied and they have been barred from marketing individual kinds of goods.

One effective method for dealing with this is cooperation between the technical control services and the territorial state standards organs.

[Question] What kind of role does the technical control department play in these matters?

[Answer] The organs of technical control should erect barriers against spoilage. More than 300 of these services comprising more than 6,300 specialists are operating in the republic.

The party and government have passed a number of decrees aimed at improving the organizational structure, extending rights, and enhancing the responsibility of the technical control organs. Not all workers, however, are displaying sufficient firmness and principledness, and pressure is sometimes applied to an administration to fulfill the plan "gross" and thus obtain bonuses. During the state inspections we check output accepted by the technical control department and ready for shipment, but a considerable proportion of it is still substandard.

The conclusion is that at a number of enterprises and associations the technical control departments are failing to cope with their direct duties. In order to enhance responsibility and improve methodological guidance in the work of technical control, in September a council of chiefs of technical control departments was set up under the Latvian republic administration for state standards.

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WORK OF LATVIAN MECHANIZATION, AUTOMATION PLANNING BUREAU DESCRIBED

Riga SOVETSKAYA LATVIYA in Russian 11 Mar 84 p 2

[Article by E. Krukovskiy, director of the Central Planning and Design Bureau of Mechanization and Automation, honored worker of Latvian industry: "The Effectiveness of the Quest Is Growing"]

[Text] As is known, the greater the scale of its introduction and the better it meets the urgent requirements of present-day production, the more significant the effect of any innovation. The administration and party organization at our Central Planning and Design Bureau for Mechanization and Automation take care that each worker always understands this, and they try to focus the collective's efforts in decisive directions.

These directions were clearly defined in the CPSU Central Committee and USSR Council of Ministers decree "On Measures To Accelerate Scientific and Technical Progress in the National Economy." It is emphasized in this decree that in the coming years there will a need to produce machines, equipment and other output that will be as good as the latest models, and to accelerate the introduction of progressive technological processes, and on this basis substantially improve labor productivity. The bureau collective is working to resolve this task in close contact with many industrial enterprises and scientific organizations in the country.

Improving instrument production occupies a central place in our work. One of the design-technological departments is a unique kind of coordinating center that works on long-term plans for the development and technical rearming of instrument production in our sector. Its specialists are working actively to introduce various innovations at the enterprises. With their help, for example, a system of technological preparation and management of instrument production developed at the Latvian State University imeni P. Stuchki, is being introduced. It is considerably facilitating and speeding up laborious work connected with calculating the entire technological cycle in the fabrication of any given instrument or tool. These systems are already successfully operating at a number of enterprises, including the Riga Electrical Machine Building Plant, the Riga State Electrotechnical Plant imeni V.I. Lenin, and the Radiotekhnika and Kommutator production associations. Use of these systems is making it possible to save R1.5 million annually.

The specialists in our bureau devote much attention to the development of progressive technological processes for the fabrication and hardening of shaping parts in technological tools and instruments. Electroforming and electromachining, pressure working of metals and powder metallurgy, and casting methods and laser methods are all being placed in the service of instrument production and being introduced at enterprises in the sector.

Our designers also deal with the development of means for technological tools. During the current five-year plan 12 kinds of equipment have been planned for the mechanization of fitting-and-finishing work, finishing work, and improving tool durability. A fitter's machine for polishing parts on the "Visma-M" that are difficult of access, a burin-sharpening tool, and a set of polishing machines have gained deserved recognition among manufacturers. Most of this and other new equipment has already been put into series production and introduced at the enterprises. Last year alone its use saved about R600,000.

Specialists at our bureau are making a substantial contribution to the introduction of automated design systems in the national economy. In 1983 development work was completed on a system for automated preparation of control programs for three-coordinate working on numercially controlled machine tools. Eight enterprises have already introduced it.

The territorial center for automated design of shearing dies recent went into operation at the Central Planning and Design Bureau for Mechanization and Automation. In our view this is a promising innovation offering advantages to the enterprises. All that is required is to input to a computer information about a part and, using the "Avtoshtamp" system, it is possible to obtain exhaustive data on metal cutout and the die design required for its production, and also working drawings for the die, the technology to be used in its fabrication, and control programs for NC machine tools. Use of the system makes it possible in less than one working day to carry out work on which designers, technicians and draftsmen would normally spend 100 to 130 hours.

We have recently been paying more attention to the development of robot technology. This is to be expected. The present level of production requires qualitatively new mechanisms that can replace people on sectors where work is heavy or monotonous, does not require great skill, or is associated with harmful conditions. As the head technological organization our collective has been given the assignment of developing means of robotization for machine processing, and of coordinating this work in Latvia, Lithuania and Estonia. In order to accelerate this work we have set up a special design-and-technological department for robotization which has at its disposal a facility for testing and adjusting robots and robot-technical complexes.

We are giving a great deal of attention to the development of flexible automated production facilities as an important means for accelerating technical progress. These means lead us right up to the organization of production facilities where "self-controlled" equipment will completely replace people at all stages, from feeding in the raw material and billets to warehousing and doing the accounts for finished products of guaranteed quality. High reliability in each of their elements is required for the uninterrupted operation of flexible production facilities. And improving this reliability will evidently be one of the most complicated problems.

In resolving these important matters much will depend on the initiative and persistence of our engineers and designers. And we have many real enthusiasts. For example, I. Genkin, chief of the robotization department. He has managed to gather about himself a group of capable, enthusiastic specialists like sector chief N. Minchenko, designers U. Biksh and N. Fedoseyev, and worker-inventor A. Nikopskiy.

The high creative potential of our inventors and rationalizers is confirmed by the fact that last year alone they submitted 20 applications for inventions. The innovators and creative teams working to solve complex technical problems are particularly creative. These teams have been set up in many departments and this is helping to reduce lead times for and improve the quality of planning and design work. Thus, the creative team led by V. Zorde and S. Mogilevskiy has offered many valuable proposals in developing and introducing at one of the enterprises a section for automated computer-controlled electromachining tools for fabricating parts for blanking dies.

The intense creative quest by specialists in all the departments of our bureau is producing fine fruits. This can be seen from the following figures. Whereas at the start of the five-year plan the saving realized from R1 of expenditure was R1.39, in 1983 this figure reached R1.62. This year we plan to increase this indicator to R1.85, and I am sure that the collective is capable of this.

True, the effectiveness of our work is often reduced by a certain lack of organizational coordination. For example, the management of the all-union industrial association of which our organization is part limits the bureau collective in terms of the volume of work done through direct economic agreements. But increasing the volume of work done in accordance with agreements would help us to shorten the road for introducing many innovations in production and would be of great assistance for enterprises both within the sector and throughout the republic.

Much of the time of highly skilled specialists is spent on compiling numerous reports. This is quite justified when we are reporting on the indicators for themes set by the Gosplan and the Central Statistical Administration. However, the association management also requires reports from the bureau on another 24 indicators. Naturally, this petty administrative tutelage constrains the initiative of the bureau workers and hampers the collective in concentrtaing its efforts on the main directions of the creative quest.

Eliminating these and other encumbrances will help the collective to improve the results of its labor and increase its contribution in accelerating scientific and technical progress.

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RIGA POLYTECHNICAL INSTITUTE COOPERATES WITH PRODUCERS

Riga SOVETSKAYA LATVIYA in Russian 13 Dec 83 p 2

[Article by Ya. Suna, chief of the department for organizing the introduction of scientific research work, Riga Polytechnical Institute imeni A.Ya. Pel'she: "The Scientific Potential of the VUZ"]

[Text] Under present-day conditions it is especially important that engineers at enterprises help in introducing into production everything new that is proposed by science. A taste for this work is instilled within the walls of the technical institutes, for, as a rule, each such institute is a major scientific center.

At the Riga Polytechnical Institute scientific research work is being conducted in 17 directions by about 1,500 teachers and scientific associates. The students are recruited extensively to participate in developments. The institute conducts basic research in accordance with a range of subjects set in the state budget, and also does work in accordance with economic agreements with enterprises and administrations that provides for specific aid for them in developing new equipment and introducing it in production.

It is not happenstance that the scientific potential of the Riga Polytechnical Institute is constantly growing. Thus, the saving derived from institute developments last year amounted to R13 million. However, our scientists' contribution to the development of the national economy could be considerably greater if the manufacturers showed more interest in the innovations proposed.

As is known, the process of developing new equipment includes the development and its subsequent introduction in production. And both these stages should take as little time as possible. This was the attitude adopted in the recent CPSU Central Committee and USSR Council of Ministers decree "On Measures To Accelerate Scientific and Technical Progress in the National Economy." It is important simultaneously to enhance the effectiveness of scientific research work and achieve broader utilization in production of what is new. To ignore these requirements leads to a situation in which many models of equipment today become obsolete well before they are worn out.

Unfortunately, the process of introducing new equipment is too often dragged out and development times are significantly exceeded. Now, for example, the average lead time for introduction into production is 2 years. Under these

conditions our scientists make every effort to accelerate the appearance of new equipment and technology in the plant workshops. We maintain constant links with the enterprises and strive to take their requirements into account. Creative cooperation is reflected in the fact that our scientists participate actively in introducing developments and jointly evaluating their economic effect, and in defining the range of current problems. Production applications are also dealt with in the dissertations of the scientific associates and the diploma work of the students.

The cooperation between the Riga Polytechnical Institute and the Al'fa production association serves as a good example of these close businesslike links. We concluded a cooperation agreement to develop, assimilate and introduce microprocessor-based facilities and provide training for specialists in this field. A good effect is derived from the scientific research laboratory for introducing research in mechanics and means of communications, financed by the Riga Electrotechnical Plant imeni V.I. Lenin.

In our experimental laboratory we fabricate instruments and devices developed by institute scientists. However, the production facilities of this laboratory enable fabrication only of test models. From there things must be handled by the enterprises. And they do not always show the necessary interest. It was not by chance that it was noted at the CPSU Central Committee June (1983) Plenum that with regard to introducing in practice the achievements of science and technology, things are by no means as good as they should be; and the need was emphasized for the development of the kind of system of organizational and moral measures such as would make it unprofitable to work in the old way.

Meanwhile, however, enterprise management includes many who love the quiet life. For much scientific research, questions of industrial assimilation are resolved only extremely slowly at the local level. Sometimes the introduction in the republic of developments proposed by the scientists at the Riga Polytechnical Institute is even delayed in cases where such developments have been positively assessed and the representatives of many enterprises have shown an interest in them. Thus, 6 years ago an acoustic decorative fabric with good qualitative and technical indicators was developed in the chemistry department. Inquiries came in from many enterprises in the country. However, all efforts to introduce this development in our republic have been unsuccessful.

Another example. Institute scientists developed an electronic rev stabilizer for low-powered single-phase a.c. electric motors. The device eliminates overrevving of electric motors in manual electric tools when they are idling and stops impact loads when tools are repeatedly used for short periods, which considerably prolongs the service life of the electric motor. Testing was completed 3 years ago and positive reports were obtained, but the question of series production of the stabilizer has still not been resolved.

While the enterprises fail to take a more active position in the matter of introducing scientific developments the actual national economic benefits derived from research by scientists will be much less than they could be. It is high time to deal more strictly with those who prefer to work in the old way. And then the effectiveness of the scientific quest will be maximum.

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ACADEMICIAN KOLOTYRKIN DISCUSSES ECONOMIC ROLE OF SCIENCE

Moscow YUNOST' in Russian No 12, Dec 83 pp 98-101

[Interview with Ya. M. Kolotyrkin, by L. I. Kuleshova, correspondent; date and place not specified]

[Text] Based upon the combination of our social order's advantages and the achievements of the scientific-technical revolution, the CPSU is working out a plan for the country's social and economic development. The 26th CPSU Congress and subsequent plena have repeatedly expressed concern about the necessity of a general acceleration in technical progress, a steady growth in basic science so that scientific achievements be introduced into the national economy and environmental protection. Among the problems facing the various areas of science are the quite important ones being studied by physical chemistry and its subdivision electrochemistry. YUNOST' correspondent L. I. Kuleshova talked with Academician Ya. M. Kolotyrkin, Hero of Socialist Labor and director of the Physico-Chemical Institute imeni L. Ya. Karpov. She asked him about the role of his science in our society and about his institute's activities and work.

Correspondent: Why have problems in the economics of natural resources now acquired such major importance? How real, Yakov, Mikhaylovich, does the threat of the exhaustion of vitally necessary natural resources, seem to you?

Ya. M. Kolotyrkin: Forecasts about the future always have an element of exaggeration, permitting one to be skeptical towards them. However, the reality of the exhaustion of oil and gas reserves, through which humanity now covers about 70 percent of its energy needs, is becoming obvious: Remember that on an average, fuel consumption doubles every 10-15 years. Consequently, explored reserves of oil and gas are sufficient only for a few dozen years.

For chemistry this poses the problem: "To be or not to be?" By the end of this five-year plan oil and gas will be the basis for the production of 98 percent of organic synthetics: all sorts of plastics, films, fibers, coatings. Naturally, chemical production is faced with the task of converting to the use of new energy sources.

What about these sources? Above all, this means the use of nuclear reactors as the energy "heart" of chemical enterprises. This will not only sharply reduce the consumption of oil and gas as fuel, but will also permit the most economical satisfaction of chemical production's needs for various types of energy. Even this, however, is not the main payoff. Until recently, we viewed the radiation accompanying nuclear energy conversion as an unavoidable evil requiring complicated protective measures. Nevertheless, radiation and wastes from nuclear processes are also energy! In addition, from the perspective of a consumer such as the chemicals industry, these are more "concentrated" energy. The broad research conducted at our Physico-Chemical Institute and others has made it possible to create a number of effective radiation chemistry processes. Many of them have already gone outside the laboratory walls and can be introduced on a large scale.

The radiation modification of polymers is of great interest. The polyethylene obtained with the help of ionizing radiation saves 100-200 rubles per kilometer of insulated cable. Irradiated polyethylene pipes can replace metal pipes in industrial and municipal water supply systems. Radiation treated polymer-concretes, resistant to the effects of moisture, low temperatures, and corrosive agents are irreplaceable in the construction of chemical enterprises, underwater facilities and installations for desalinating seawater. These polymer concretes substantially facilitate construction and reduce its costs.

Radiation technology, first developed by Soviet specialists, will make it possible to more completely use the potentials of nuclear fuel and reduce the operating and prime costs of the energy obtained. In recent years many countries have been working on radiation methods for utilizing wastes. The irradiation of wood shavings, chips and sawdust will yield large additional amounts of cellulose. The irradiation of wastes containing cellulose will increase the output of glucose essential for mixed feeds production, extend the active period of nutrients, helping to increase yields. According to preliminary studies, the economic effect from the application of 1 ton of such fertilizers will amount to about 3,000 rubles if there is a 25-30 percent increase in feed crop yields.

Correspondent: How do you evaluate the place of your science in the general system of human knowledge? What can it give to people and what are its most promising directions?

Ya. M. Kolotyrkin: The chemical industry's transition to new energy sources is only beginning. One cannot even conceive of contemporary power engineering without the achievements of electrochemistry. It began its contribution with the creation of chemical sources of energy, which are indispensable to modern technology.

One of electrochemistry's most important and fascinating problems is the direct conversion of chemical energy into electrical without any losses, that is, with an efficiency coefficient almost equal to 100 percent. Devices for the direct conversion of solar energy into electrical or chemical will be widely used in the not too distant future. Low cost and large capacity electrochemical batteries will be essential for the use of energy from the sun, winds, tides, small rivers, etc. There already electric automobiles, the vehicle of the future. One hopes that with the chemical industry's transition to nuclear energy, electrochemistry will produce energy which does not pollute the atmosphere.

Electrochemical processes produce very valuable products: a number of metals, chlorine, flourine, hydrogen, alkalis, heavy water, oxidants, and substances which are difficult and even impossible to obtain by ordinary methods.

With the help of new methods it has been possible to desalinate seawater, effectively clean sewerage, and render industrial and domestic wastes harmless. I think that these methods will have no competition in widespread use for the development of waste free technology of the future.

Electrochemistry is involved in many processes taking place in living matter, for example, the generation and propagation of nerve impulses, image perception and the contraction of cardiac muscle.

Correspondent: You have devoted many years to studying the causes and mechanisms of corrosion and the development of various anti-corrosion methods. Just what is it about this subject that interests you?

Ya. M. Kolotyrkin: In my opinion, the struggle against corrosion and the damage it causes is one of the most important and urgent tasks facing humanity. In industrial nations the losses from corrosion have reached magnitudes comparable to the outlays for the development of very large industrial sectors.

In the chemical industry corrosion is almost twice as intensive as the average for the national economy. Why then don't chemists stand in the front ranks in the struggle against corrosion? A new science has now been born, it could be called the chemical resistance of materials. This discipline should be a required course at every engineering institution.

Correspondent: Yakov Mikhaylovich, for almost 30 years you have been the head of the Physico-Chemical Institute imeni L. Ya. Karpov, one of the first scientific institutions created in our country after the October Revolution. This year is the 60th anniversary of your institute. What especially important problems must the institute's scientists solve and what must be done in the future?

Ya. M. Kolotyrkin: Our institute was created during the civil war -- 4 October 1918. V. I. Lenin, V. V. Kuybyshev, G. K. Ordzhonikidze and F. E. Dzerzhinskiy were personally concerned about its development during the difficult initial period. It was organized by Lev Yakovlevich Karpov, the first leader of the Soviet chemicals industry and a major revolutionary and by Aleksey Nikolayevich Bakh, a scientist and a prominent activist in the revolutionary movement. The institute's first associates were engaged in problems of meeting the country's most pressing needs. The civil war and the general devastation forced them to mobilize very limited resources. Thus, sources were found for the then extremely scarce detergents and aviation lubricants. The institute's scientists found ways to accelerate the drying of peat and coal. This made it possible to show the technical feasibility and then to begin the construction of the Kashira and Shatura GRESes, the first units of the GOELRO [State Commission for the Electrification of Russia].

During the Great Patriotic War a number of laboratories were converted into defense enterprises for the scientific guidance and organization of new production operations. Electrochemical explosives developed by our associates found widespread use at the fronts (and in the fascist aggressors' rear area). Scientists proposed a new method for producing activated carbon, catalytic heaters for warming tank engines, protective synthetic materials and new types of heat and cold resistant galvanic materials.

Soviet physical chemistry, which has received deserved world recognition, was born and developed at our institute. The institute's fundamental and theoretical research is invariably linked to practical application. For example, the theory of ammonia synthesis is widely used in designing modern enterprises in the nitrogen industry. Our scientists have created and already industrially introduced methods for producing new high quality insulation tape necessary for the electronics and electrical engineering industries and for motor vehicle and ship building. There is great promise in the radiation modification of wood, making low quality species and material equal, and in some cases, superior to oak and beech.

One of the laboratories has created new types of highly effective filter materials from thin fiberglass. It has also industrially introduced original designs for filtration devices. It would be no exaggeration to say that without such items there would be delays in the development of nuclear power engineering, the production of especially pure substances and in many other types of production. This filters and methods have become irreplacable for removing bacteria from the air in operating rooms and even in poultry units.

Interestingly, these filters solved a difficult problem in the preservation of art objects. Under the leadership of Academician I. V. Petryanov-Sokolov, a method was developed to insulate the display windows in museums, helping to isolate these unique treasures -- old pictures, ancient manuscripts, very rare fabrics and carpets — from the effects of harmful aerosols. The display windows at the Oruzheynaya Palata, the Almazniy Fond, the Russian Museum and other art treasures are now equipped with such filters.

Correspondent: Yes, physical chemistry has to solve many important problems. However, other sciences are not standing still either. There is an increasing gap between their growing number and their real potential. Apparently, one cannot simply depend upon growth in the number of scientists, after all human resources are limited.

Ya. M. Kolotyrkin. It seems to me that it is now especially necessary to increase the "return" from scientists' labor. This can be done in various ways. To begin with, at our institute, for example, the research volume is increasing, but the number of associates has not changed for many years. What kind of reserves help us? Of course, this has to do with the careful selection of talented youth and improvements in work organization and laboratory equipment. Year after year we are concerned with this, but it is also essential to improve the system of material incentives to scientific workers, increase the personal interest of each associate in the efficiency of his creative work and that of the collective. This was helped by the introduction, in 1968, of a new system of payments for labor at our institute.

The previous traditional system of wages for positions and academic degrees did not promote improvements in scientific workers efficiency. The only way to get a raise was to get a candidates, or even better, a doctors degree. After obtaining the desired degree there was no longer any incentive to improve work productivity. After all, wages did not depend upon the importance of the research, innovations or efficiency. Many people avoided further research on innovations genuinely important for theory and practice. All this made it necessary to think about another system for paying labor.

It isn't easy to discern who is talented, mediocre, lazy or diligent, who has come to science as a calling, or only to "protect themselves" and obtain a guaranteed "rent" from an academic degree. A given position can be held by people with varying capabilities, responsibility, diligence and independence. According to the job description their pay is equal, even though the results are different. However, the social evaluation of their activity will correspond to these results, and we too have decided to orient ourselves towards them.

Special questionnaires were carefully prepared for each associate. The questions were direct: Is this associate capable, diligent, sufficiently trained theoretically, show initiative, independence in preparing experiments or more inclined to use the ideas of others, how much original research has been completed?, and so forth. At the end it was asked if the associate deserved a raise, cut or the present pay. The guaranteed pay level newly established for each category of associate was 25-30 percent below the usual level.

The main difficulty we encountered was that many laboratory leaders did not have the courage to objectively evaluate the work of their associates. Who, if not they, would have a good knowledge of the true effectiveness of each colleague? They often wanted to take the position of a comrade threatened by an unsatisfactory evaluation and consequently, by a pay cut. It was necessary to remind them that they should not be generous with the state's money.

After the new system's introduction, a distinguished associate without a degree can earn more, not less than a degree holder working listlessly. It no longer makes sense to defend a poor candidates degree; material incentives influence moral ones. Pay now depends upon social evaluation and professional standards. It touches upon questions of prestige, authority and self respect. One senior scientific associate received a ten ruble cut. He said he was prepared to contribute 100 rubles a month to the institute if we wouldn't loose the "prestigious" ten. Many who got pay cuts left the institute. Relieved of this deadweight, we didn't complain.

Prior to the beginning of the assessment there were skeptical discussions. It was thought that it would get "give backs" from junior associates, while it wouldn't dare to touch senior associates. It did dare! Especially strict demands were made upon the most qualified part of the collective, bearing the main responsibility for the direction of the laboratories' work and the research standards. Almost 30 percent of the senior scientific associates received negative evaluations. These were candidates and doctors of science, who felt they had attained their peaks and preferred to quietly reap the fruits of previous labors. This measure shook up some of them and drove them out of "hibernation", while others thought it better to leave the institute.

The new pay system didn't only affect scientific associates. We are also evaluating laboratory assistant, employees, workers and engineers at experimental machine shops. Skeptics' predictions about inevitable distrubances of the collective's normal work did not turn out to be true. On the contrary, discipline improved without any sort of administrative pressure. While previously scientific associates considered it a necessary evil to walk to storage areas for reagents, instruments or equipment, under the new conditions they justifiably demand to be relieved of this work. There were many suggestions on improving auxiliary services. The majority were introduced. Moreover, there has been a five fold increase in the number of inventions and articles in scientific journals.

In the reassesments following the first one (in all there were seven) there were more wage increases than decreases. The increased responsibility for one's work now prevailing at the institute has helped us somewhat increase the research volume while using the same number of staff. Our example has been followed by more than 60 scientific institutions.

Correspondent: Are you satisfied with the new young workers at the institute?

Ya. M. Kolotyrkin: We often heard complaints about beginning scientists. Their first years of independent work were confusing, there wasn't constant leadership and the work was unsystematic. We decided to try to avoid this.

In order for young specialists to more quickly and knowledgeably engage in serious research, they are considered trainees during their first year of work. They are assigned scientific leaders, who, together with them, are responsible for subject selection, set up and supervise work with the literature, theoretical preparations, experiments and the publication of their first scientific works. After a year the collective receives "not a youth, but a grownup", capable of independent work. At this time any salary deductions due to youth or inexperience are ended and the young scientists are subject to the same demands as the remaining associates.

Our institute has strong and active Komsomol and youth organizations involved in a large part of the work with youth. The council of young scientists is capable of any task. Its activities are known far beyond the Moscow city limits. For three years the council has conducted the All Union Conference of Young Scientists in Physical Chemistry. Youth from all corners of the country bring their work in the basic areas of this science. Their reports are discussed and evaluated in a competitive manner by the most prominent scientists at the institute. The better works are awarded.

The council's activities are diverse. They include the very popular journal KARPOVSKIYE SREDY, and philosophical and methodological seminars to assist young people.

Komsomol members recently set up a Council for the Scientific-Technical Creativity of Youth to promote the activities of young engineers and workers. Once or twice a year this council has competitions for original technical developments, interesting methodologies and innovators' proposals. The better

work from these finds practical application here and are introduced at the institute's experimental shops. In this manner we have obtained several unique instruments useful for scientific research essential to the national economy and having a number of advantages over foreign models. An exchange fund of experimental equipment, set up on the institute's initiative, is successfully operating. It makes it possible to temporarily use scarce instruments necessary for work.

I am pleased with the creative audacity and creativity of our Komsomol members, but this is now insufficient. As the role of science grows, so does the urgency of improving the efficiency of scientific research and very rapidly introducing results. Every year science is becoming more expensive. On an average, the costs per scientific worker double in 10 years. Naturally, the coefficient of "return" on scientists is acquiring ever greater importance. It is essential to use and develop all methods which improve scientists' labor productivity.

It is especially valuable when young people find these new forms. At our institute there is an interesting and very effective combination of young creative efforts -- the Komsomol youth collective led by Yu. Filatov, a young associate and candidate of science. It arose five years ago when a group of young workers from the laboratory of Academician Petryanov-Sokolov decided to test their efforts at absolutely independent work. They undertook a difficult, vitally important task -- the development and introduction of new filter materials for the microbiological and food industries. In a short time they succeeded in creating a polymer from which filter fiber having all the essential qualities could be obtained. Young designers enlisted into the collective's work, developed original designs for new filters. Our associates are being asssited in their introduction into medicine and industry by young specialists from Sverdlovsk, Ufa, Alma-Ata and Estonia who have also entered the collective. They were able to organize the factory production of the polymer and filter materials. The economic effect from the use of these materials in the microbiological and food industries will amount to more than 1 million rubles.

The collective's work has already been given two prizes: in 1979 an award from the Moscow Komsomol and in 1982, one from the Lenin Komsomol.

The Komsomol years are very important and unforgetable ones in a person's life. I often recall those years and can confidently say that I am obligated to the Komsomol for everything I know, can do, and was able to achieve in science and life. My Komsomol generation of the 1930's passed a severe, but outstanding school of struggle. We were participants in industrialization and the collectivization of agriculture. The Komsomol sent us into science as if it were a critical front. "Not a day without struggle, not a day without creativity!" I have carried this main precept of my Komsomol youth with me throughout my entire life and also attempt to impart these qualities upon young colleagues and scientists.

Nature has given humanity a valuable gift -- the capability of creativity. This gift is manifested in an especially brilliant manner among young people. The thirst for new discoveries, the striving to penetrate into the unknown and make it serve humanity -- these are an eternal flame without which great accomplishments are unthinkable. At birth every human being has sparks of this flame, but in order for it to ignite into a bright fire giving heat to people it is necessary to do much work, not fearing difficulties and new roads.

I have been engaged in science for almost 50 years and would in no way hold that creativity is the privilege of scientists, designers or artists. No matter where a person works: a drawing board, lathe, electronic microscope or coal face, such labor can always be made creative. I recall many cases where it was the labor of workers, technicians, laboratory assistants, ordinary engineering production workers and their sometimes unexpected suggestions helped scientists more rapidly master and introduce complicated technological processes. In any activity, however, just as with science, this requires knowing much and studying constantly.

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NUCLEAR PHYSICISTS REMINISCE OVER CAREERS

Moscow NEDELYA in Russian No 9, Mar 84 pp 17-18

[Interview with A. P. Aleksandrov, Ya. B. Zel'dovich, and Yu. B. Khariton, by Yevgeniya Al'bats, date and place not specified]

[Text] In 1912 Ernest Rutherford introduced the word "nucleus" into physics. At that time nobody could have thought that this term would become a symbol of the 20th Century. The new physics began and dozens of scientists in various countries were to be the bricklayers of its new structure. Among those who laid their "stone" in the foundation of the new physics and who have been building its stories throughout their entire lives, are Soviet scientists known throughout the entire world. The occasion for this discussion on the pages of NEDELYA is the 80th birthday of Yuliy Borisovich Khariton and the 70th birthday of Yakov Borisovich Zel'dovich. It is, of course, purely accidental that their birthdays almost coincide and that they are celebrating them together today at scientists' councils and celebrations. It is also coincidental that they were both raised in humanistic families and that their attraction to physics wasn't logical from the perspective of these family traditions. Yakov Borisovich is the son of a well known woman translator and a jurist, while Yuliy Borisovich is the son of an actress at the Moscow Khudozhestvenniy Teatr and a journalist. These are not accidental: both future academicians began their work very early: one at 13 and one at 15; and both became well known in science very early. Khariton was 21 when he became one of the authors of a physics problem book, which has since been published in 17 editions! At 22 Zeldovich defended a candidates dissertation and 3 years later a doctoral. One could fill several pages with such comparisons. Therefore our first question is: How did they get acquainted and what was the reason for their first joint research?

Yu. Khariton: Once we were visited at the Institute of Chemical Physics, which had just branched off from the famous Leningrad Physico-Technical Institute [Fiztekh], by an excursion group from the Institute for the Mechanical Processing of Minerals..This was perhaps in 1931. Among the group was a young

lad who distinguished himself by his very serious questions. It was simply impossible for him not to attract attention. He especially interested the well known scientist S. Roginskiy, the head of the catalysis laboratory. He suggested that the young man participate in the institute's work. Yakov Borisovich, who was hardly 17 at the time, started visiting the institute every evening. After some time, at the request of A. F. Ioffe he was transferred from the Physico-Technical Institute, I think it was sort of a labor exchange. It is hard to give an exact date for our acquaintance. Possible Roginskiy introduced us, or, and this is more probable, it happened at a seminar.

Ya. Zel'dovich: Yuliy Borisovich impressed me as a very serious and mature person. In addition, he had the halo of a scientist who had gone to the school of Rutherford himself and had worked at the noted Cavendish Laboratory -- the center of nuclear research in those years.

At first our scientific contacts were quite rare. I was involved in the theory of adsorption, while Yuliy Borisovich was working with explosives. However, it seems to me that my most fruitful stage began at the end of the 1930's. I was interested in problems in the theory of combustion and detonation. Khariton was already a leading figure here, therefore I often turned to him for help. Our friendship really began at that time. Initially it was the friendship of student and teacher, later one of similar thinkers which lasted. Yuliy Borisovich, it has been almost a half century! Incidentally, in spite of this, we have not switched over to using "Ty". As far as I can recall, I have always called you by your name and patronymic.

Yu. Khariton: I read somewhere that at Fiztekh they called me Lyusey... It must be said that that is a legend. They called me that only at home....

Ya. Zel'dovich: (Laughs) I learned that supposedly Ioffe had replaced me with a pump, but that is not important. The entire course of events and the direction of our work led us to start working in very close contact. Perhaps, however, the decisive event was the discovery, by the German scientists Lisa Meitner and Otto Hahn, of the fission of uranium. The nuclear chain reaction became possible in principle. Possible, but under what conditions -- all that remained very cloudy. At that time we decided to make a detailed study of this problem. Our first joint article appeared, then a second....

Yu. Khariton: Please excuse me for interrupting, Yakov Borisovich, but I recall an amusing incident here: Long before the discovery of the fission of uranium, Nikolay Nikolayevich Semenov, a man of tremendous intuition and the deepest understanding of the subtleties of phenomena, bothered various physicists with the same question: Are you certain that there really cannot be a chain nuclear reaction? They brushed it aside, saying it was rubbish.

Ya. Zel'dovich: Yes remember, that even Rutherford himself was very skeptical about the possibility of accelerating the release of nuclear energy and its practical use. He felt that it was impossible and that only a fantast could think about it. Recall that Niels Bohr wrote that the broader becomes our knowledge about nuclear reactions the more distant seems their future... And what about the predictions of Ida Noddack?

Khariton: Yes, little was known about this. Back in 1934, the very good German chemist Ida Noddack (together with her husband she discovered Rhenium -- the last stable element in the Mendeleyev Table) expressed the quite seditious thought: could an atomic nucleus be split into 2-3 parts under bombardment by neutrons? She asked Hahn to talk to physicists about this. Hahn's answer was very abrupt: What is the sense of it? If she did not want to loose her reputation as a good scientist, then it was best not to talk about such nonsense....

Ya. Zel'dovich: At that time you called her a Cassandra....

Yu. Khariton: A Rhenish Cassandra. Her prediction was not heard. The article was published in a journal of applied chemistry, and physicists, unfortunately, don't read chemical journals. Incidentally, to avoid confusion, I turned out no better than the rest. I also learned it post-factum. An this was, after all, something which would certainly have an effect upon the course of history.

The phenomenon was discovered four years later....

Yu. Khariton: Four years is a long time.

Ya. Zel'dovich: More precisely, Hitler could have had the atomic bomb...

However, we have gotten of track. Its true that in those years most had extreme views: Hahn's discovery, of course, shook up everybody. I recall that there was even an article which said that volcanos were nothing other than underground nuclear explosions. Later we showed that this wasn't true and that neither metallic uranium, a mixture of uranium and water, nor oxides of uranium could produce a chain reaction without the separation of isotopes. The role of delayed neutrons was also formulated. In short, without going into details, they are now quite widely known, we explained very precise kinetic effects and calculated the conditions for a chain reaction to occur. It was unusually interesting work, although at times we had to stay up all night. The calculations on the critical mass of uranium-235 were especially difficult.

[Question] "All the free minutes are given only to her, only to physics: she is our goddess and our mother." It seems that these were the watchwords at Fiztekh.

Yu. Khariton: Its true. Only they were written earlier, back in the 1920's.

[Question] Would you like to say that in the 30's there was even less free time?

Yu. Khariton: There was never enough. However, this subject was hardly of interest. Normal people went to the theatre, to exhibits and fell in love....

Ya. Zel'dovich: It is fitting here to recall the beautiful statement by Mayakovskiy: "I am a poet and I am interested in it...." Remember, Yuliy Borisovich, we even started to learn Italian in order to read Enrico Fermi's articles in the original.

Yu. Khariton: I remember another funny situation. At first it seemed to us that we were involved in an extraneous problem which was not part of our immediate obligations. We therefore engaged in this study in a small room at the institute only in the evenings, after we had finished what we felt to be our main work. Remember that it seemed to us that the enrichment of uranium would take a building a kilometer long? In general, we expected many complications. Incidentally, our last article devoted to the calculation of the critical mass was sent to the journal, USPEKHI FIZICHESKIKH NAUK just before the start of the war and did not appear. It was published just recently, but only for historical interest.

A. Aleksandrov: The work of Yuli Borisovich Khariton and Yakov Borisovich Zel'dovich in the chain reaction fission of uranium can be called pioneering in the full sense of the word. They were the first to correctly calculate the conditions for a nuclear chain reaction process. They also developed the theory of the resonance absorption of neutrons by uranium-238, pointed to the possible role of delayed neutrons for regulating reactor operation and examined the effects of moderators. I remember when Yuliy Borisovich made a detailed and successful report on these projects at a traditional Fiztekh seminar.

I got acquainted with them back in the early 30's when, at the invitation of A. F. Ioffee, I went to Kiev with a group of physicists.

My friend Pavl Pavlovich Kobeko and I went to Khariton's laboratory especially to see the phosphorus oxidation reaction, the luminescence of which clearly showed a chain reaction break. Yuliy Borisovich did this work while still a student. N. N. Semenov used this discovery as the basis for the theory of branching chain reactions.

In spite of the break-up of Fiztekh there continued to be a general seminar attended, incidentally, by physicists from all over Leningrad and other cities. Here is a curious detail: Yuliy Borisovich always sat with his eyes closed, making it look like he was sleeping. However, he always heard everything and posed the most interesting questions.

In the middle of the 30's the restructuring of the Fiztekh laboratory began. This did not involve any sort of formal rearrangements, but only changes in work direction. For example, prior to this I was involved with problems of dielectrics, after the restructuring I studied the physics of polymers. Igor' Vasil'yevich Kurchatov was interested in nuclear physics. Shortly thereafter he did a huge amount of work. He supervised projects at Fiztekh and at the Radium Institute, where a cyclotron was being built, and at the pedagogical institute. Scientific institutions from other cities, for example, Kharkov, were included in this work. N. N. Semenov planned work on chain reactions. However, this work was stopped when the war started.

The institutes were evacuated to Kazan, and at that time I completely parted ways with Khariton and Zel'dovich. They were initially working on antitank grenades. Later Yakov Borisovich worked on the combustion of propellents for "Katyusha" rockets, while Yuliy Borisovich worked on various explosives, aircraft bomb fillings, etc. I was working on antimine protection for ships.

Kurchatov was in my group. In 1942 Igor' Vasil'yevich was entrusted with making proposals for expanding work on nuclear physics. This was a result of Georgiy Nikolayevich Flerov's writing Stalin a letter stating that all evidence pointed to the Germans doing extensive research in this area. We all had a similar impression. The names of German and English scientists working in nuclear physics disappeared from the physics journals. This could mean only one thing: all research was classified. Kurchatov went to Moscow. After some time he called Kikoin from Sverdlovsk. In the beginning of 1943 my laboratory began to be interested in these problems. A year later, after returning to Leningrad, we were quite broadly engaged in the subject matter of interest to Igor' Vasil'yevich.

Institute of Chemical Physics did not return to Leningrad, it was moved to Moscow. Zel'dovich was called to the capital somewhat later than Khariton.

We now and then met with Yuliy Borisovich. At that time I noted that Khariton not only had a subtle knowledge of the matter, but was also very demanding, both upon himself and the people around him.

If Yuliy Borisovich felt that something should be done to a certain degree of accuracy, then that's the way it was. He "drew" this accuracy out of you no matter how much you resisted. However, I stress that his orders were always well argued. In the end we therefore always understood one another and our contacts always ended to our mutual satisfaction.

I didn't have so much contact with Yakov Borisovich, but all the same he was very interesting to me as a theoretician. Sometime in the middle of the 1950's Zel'dovich finally moved to Moscow and worked on problems in the physics of elementary particles and in astrophysics. He is still fruitfully working in these areas. His articles are not only distinguished by their depth, but are also very physical. In other words, unlike many theoreticians, he does not suffer from excessive formalism, where one cannot sense the physics because of too much mathematics.

Decades have passes since this time described by Anatoliy Petrovich Aleksandrov. Every year and every day in the lives of Academicians Khariton and Zel'dovich have been filled with hard, tireless work.

Yakov Borisovich has worked on astrophysics and the physics of elementary particles, thereby winning fame as a universal physicist. Perhaps J. J. Thompson, the discoverer of the electron, was talking of people like Zel'dovich when, at the beginning of the century, he said: "Of all the services which can be rendered to science, the introduction of new ideas is the most important." No matter what problems Zel'dovich is interested in, he always makes a huge contribution. At times it seems that he is interested in everything.

In recent years Yuliy Borisovich has been involved in problems of laser fusion. His circle of scientific interests is also very broad.

Finally, both academicians devote much effort to young people. Each, has set up his own scientific school. It means a lot to have similar thinkers among ones followers. This is why I asked Yu. B. Khariton and Ya. B. Zel'dovich to discuss people who in their time and in their turn had a special influence upon them, well known scientists and teachers they met....

Yu. Khariton: At one time I had the luck to work for several years with the great Rutherford. They had a special work style. While we are accustomed to give much attention to young scientists, in the Cavendish Laboratory the situation was different. A scientist was expected to be able to "work things through" on his own. I will not try to say whether this is good or bad. In any case it taught one how to work independently.

Of course, we encountered Petr Leonidovich Kapitsa. At that time he was trying to produce strong magnetic fields. I distinctly remember this picture: Kapitsa was standing at a machine for hours winding a steel belt around a coil through which a powerful current was to pass. The experiment itself only took one hundredth of a second. Petr Leonidovich, of course, had an assistant, but he preferred to do everything with his own hands. He could build anything relating to a physics experiment better than any machinist.

As far as concerns my teachers and people who had the most influence upon me, this would be, above all, Abram Fedorovich Ioffe. He was the first great physicist whom I ever met. He made an indelible impression upon me. Nikolay Nikolayevich Semenov is a scientist with the broadest reason and intellect. Later there was Igor' Vasil'yevich Kurchatov, an amazing, exceptional man! Sometimes I wonder what to do in a situation. I always ask myself: What would Igor' Vasil'yevich do?

Kurchatov was distinguished by an unusual combination of various qualities -- human and professional. A real scientist, earlier than many he felt the importance of nuclear physics and studied it when it did not bring easy victories and quick recognition. He was an organizer without equal in science.

Ya. Zel'dovich: Really, he was always in charge of huge construction operations, coordinating the work of many scientific collectives and surrounded by people with similar views. I remember that when I worked with Igor' Vasil'yevich he created a special feeling of unselfishness. He never tried to opposed other ideas with his, simply because they were his own. An interesting suggestion by any worker, independently of rank or regalia, was discussed and, if it stood up, was immediately applied. A powerful collective reason was in operation.

I said: collective reason. Here I want to recall something which I think is very important. I thought about that when we were talking about the discovery and rediscovery of the fission of uranium.

My thought consisted of the following: In principle it isn't important who made a given discovery. A phenomenon will be discovered if it is so predestined and if it exists in nature. This is where science comes in, for the result is dictated by nature, which is the same everywhere.

[Commentator] All the same, there are names in the history of science. For example, there is a Zel'dovich Number, Formula and Effect; there is also a Khariton Principle.

Ya. Zel'dovich: A name remains in our human memory, enriching us. In science, however, only the phenomena remain. In this way it is distinguished from art. Only Pushkin could have written: "Ya pomnyu chudnoye mgnoven'ye" ["I remember that wonderful moment"], and only Beethoven could have written the Moonlight Sonata, but someone other than Chadwick could have discovered the electron. However, let us return to our memory.

I. V. Kurchatov often said: "The science of physics is fine, only life is short." What huge responsibilities were on his shoulders, whan excessive work! We were all protected by his wide back. He asked us about ideas and work, but in the final account he had to face the government alone.

Kurchatov had no patience for various kinds of scientific speculation such as that Lysenko, for example, allowed in biology. Physics also had candidates for this role. They attempted to refute quantum mechanics and the theory of relativity. Once when I was in Kurchatov's office there was a phone call from Moscow. It was from some editorial board. They wanted advice as to whether or not to print an article which fulminated against the theory of relativity. Not thinking for a second, Kurchatov answered: "If you decide to print it, then this institution will have to be closed...."

A. Aleksandrov: It seems to me that the Leningrad Physico-Technical Institute played a large role not only in my fate and that of Academicians Zel'dovich and Khariton, but also in the fates of many other Soviet Physicists. Abram Fedorovich Ioffe was unusually benevolent to literally all associates. For example, if you went to the library and picked up a new journal on almost every article you read notes: Kurchatov should read this, Aleksandrov, this would be useful to Artsimovich. In short, he was constantly concerned about our education.

And his seminars! I have already mentioned how they included physicists from throughout the country. We were visited by Muscovites. Igor' Yevgen'yevich Tamm, for example, was a frequent guest. These seminars were also noteworthy in that each of us had the right to give a report on any subject. We were not only formally, but also psychologically prepared for this. We did many things with great satisfaction, entering into discussions. In disputed cases, Ioffe gave a short summary, and immediately everything became clear to us. Perhaps the most lasting impression was made by these friendly relations between associates at the institute which reigned at the house on Lesnaya Ulitsa. Unfortunately, today such a climate is a rarity in scientific research institutes.

I remember how Abram Fedorovich walked through the laboratories. Each of us expected him once a week. He asked what we had succeeded in doing, had an interesting discussion about our rešults, pointed out where and how we could be mistaken and what deserved attention. How ashamed we were if to the question: "Well, any success?", we had to answer that there was none. Preventing this required much work, and we worked.

There is no denying that Abram Fedorovich had great civil courage. I think that if it hadn't been for his efforts and those of Igor' Vasil'yevich Kurchatov,

that nucluear physics research during the middle of the 1930's could hardly have expanded on such a broad front. This work encountered stiff resistance by some authorities who felt that it was a "pure science" far removed from practical problems. They did not see the necessity of its development. In 1936 there was even a general meeting of the Academy of Sciences where we, I mean Fiztekh, were reviled in every possible way. Abram Fedorovich and Igor' Vasil'yevich stood their ground firmly. They calmed us down: It will work out, they said, everyone will gradually see the necessity of nuclear physics. As you can see, they were proven correct.

It is known that in your youth Yakov Borisovich Zel'dovich, you did not plan to become a physicist. You felt that this science was exhausted and that the most interesting things would happen in chemistry. However, at the very beginning of your scientific activity and for many years you were a witness to a genuine boom in physics. Today can one expect such a fundamental break in our ideas about nature? What science will be front stage in the years ahead and finally, what will happen in physics itself?

Ya. Zel'dovich: Physics is really changing very rapidly. There was a generation who disputed Einstein's theory of relativity and quantum mechanics. Today Einstein's equations are used by engineers to build accelerators, while exact calculations in chemistry and physics are based upon quantum mechanics. Nobody asks whether or not they are true.

In the 1930's the boom in physics involved the discovery of the nucleus. This was followed by a calmer period during which facts were accumulated. However, voices were heard in favor of various "insane" theories. Everyone has waited for and is expecting a third revolution in physics.

A huge amount of experimental material has been gathered. Quarks and the so-called W-particles have been discovered. These are essential to the creation of a unified field theory, a theory to unite all the presently existing forces: the weak, strong, electromagnetic and gravitational forces. Will theory and physics itself move ahead? Undoubtedly they will. However, all this is within the framework of previous ideas, therefore there is no need to talk of a boom in physics, as you call it. However, beyond a doubt, huge advances are being made in the work now under way.

Yu. Khariton: I am an experimenter. Therefore I would like to note the colossal accumulation of facts in sciences such as astrophysics, in which Yakov Borisovich is involved, or in the earth sciences. This is primarily due to humanity's move into the cosmos. Take, for example, the study of Venus with the help of satellites. This will make it possible to better understand the structure of the earth's core, where many things are still uncertain, by giving theoretical and applied geologists the essential information. Perhaps, in particular, here is the answer to the half joking question: Isn't the study of science a means for satisfying one's own curiosity at the expense of society?

Ya. Zel'dovich: In my opinion, Yuliy Borisovich, it is essential to make one point more precise: There are problems for which it is difficult to see a practical application, but which must be studied.

I think that the most interesting results can be found at the interface between cosmology and the physics of elementary particles. In any event, the answer to questions about the deep properties of matter must be sought here. Which science will determine the face of the 21st Century? I don't know. I assume that it will be chemistry, biology, in particular molecular biology, and geophysics. Incidentally, a new interesting science is arising. This is synergetics, the science of order within chaos.

A. Aleksandrov: The work of Yu. B. Khariton and Ya. B. Zel'dovich is also of great importance for the future of physics, because they laid the basis for the physics of reactors and nuclear power engineering. It is difficult to estimate the present and future role of these areas. Judge for yourself. Nuclear energy has given humanity an inexhaustible source of energy, thus relieving it of the problem of replacing various types of organic fuel. Unfortunately, because the world situation remains very tense, such research can not yet proceed at full force. But it will move forward and develop. Even today we are working on the use of nuclear energy for various types of metallurgical and chemical processes.

Of course, there will be fundamental research in these areas. They are the basis for the future and are making the greatest practical advances. Nuclear physics is once again an example of this.

Yuliy Borisovich and Yakov Borisovich, what would you wish for somebody who will soon be entering science, and how do you envy them?

Yu. Khariton: Why would I envy them? For their youth, of course, and also because they will see what physics will be like 50 years from now. True, the young should always remember that talent is very fine and necessary, but science requires a lot of hard work.

Ya. Zel'dovich: The capacity for self-criticism is a very necessary quality for a scientist. Another thing is honesty [poryadochnost'], absolute honesty. Of course, sometimes good, even socially necessary work is done by people with low human qualities. They write dissertations, become leaders, and sometimes even make interesting discoveries.... In other words, there is no strict correlation between moral qualities and work results. However, great science and high achievements, on the level of Einstein and Bohr, require absolute honesty. It all lies in the problem of genius and villainy.... As Rabelais wrote: "Knowledge without conscience -- is the destruction of the soul."

A. Aleksandrov: It is pleasing to note that Yuliy Borisovich and Yakov Borisovich were able to fully retain their creative capabilities. Therefore my only wish for them is to keep at it!

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ANNUAL GENERAL MEETING OF BELORUSSIAN ACADEMY OF SCIENCES REPORTED

Minsk SOVETSKAYA BELORUSSIYA in Russian 24 Feb 84 pp 3-4

[BELTA report: "The Creative Force of Science. A Session of the Belorussian SSR Academy of Sciences Annual General Meeting"]

[Text] It was noted at the CPSU Central Committee February (1984) Plenum that in the final analysis intensification, the accelerated introduction of the achievements of science and technology and the implementation of major comprehensive programs should raise our society's production forces to a qualitatively new level. The way in which the republic's scientists are laboring to carry out the party order of transforming the results of their research into a powerful production force and impart maximum practical significance to this research was discussed in a principled and exacting manner at the 22 February session of the Belorussian SSR Academy of Sciences annual general meeting in Minsk.

The opening address was delivered by the president of the Belorussian SSR Academy of Sciences academician N.A. Borisevich. Last year, he said, brought new successes for our collective. The Institute of Technical Cybernetics was awarded a CPSU Central Committee, USSR Council of Ministers, AUCCTU and Komsomol Central Committee Challenge Red Banner, while the collective of the Institute of Mechanics of Metal Polymer Systems received a Belorussian Communist Party Central Committee, Belorussian SSR Council of Ministers, Belorussian Trade Union and Belorussian Komsomol Central Committee Challenge Red Banner.

Much was done last year. More than 20 major developments were completed, aimed at implementing the Food Program, together with about 40 proposals for introduction and industrial testing in various industrial sectors. The tasks for some of these were included in this year's state plan for the economic and social development of the republic. At the Belorussian Communist Party Central Committee plenum that took place on 21 February it was noted that the scientific establishments are still exerting only weak influence on improving social labor productivity and are still insufficiently engaged in automating production processes. We must eliminate these shortcomings in the shortest possible time, N.A. Borisevich noted.

During 1984, work will be done on 339 subjects in the laboratories of the Belorussian SSR Academy of Sciences, covering the most important fields of

the natural, technical and social sciences. Economic agreement work worth close to R40 million is to be completed, and tasks are being set for 66 all-union and republic scientific and technical programs.

Realization of these tasks will depend largely on the effectiveness of basic and applied research.

The chief scientific secretary of the Belorussian SSR Academy of Sciences Presidium, academician V.A. Pilipovich, presented a reported entitled "The Scientific and Scientific-Organizational Activities of the Belorussian SSR Academy of Sciences in 1983."

During the reporting year Belorussian scientists solved a number of important theoretical and applied problems in the fields of mathematics, optics and spectroscopy, quantum electronics, solid-state physics, microelectronics and optical electronics, technical cybernetics, engineering, the synthesis and catalysis of organic and inorganic materials, biochemistry, genetics, physiology and so forth.

The academy establishments worked on 349 subjects in the field of the social and natural sciences. Research was completed on 67 of them. The Institute of Philosophy and Law, for example, prepared recommendations on improving ideological, mass political and propaganda work at the level of the labor collective and the city, oblast and republic levels. The Institute of Economics developed a draft for the Comprehensive Program for Scientific and Technical Progress in the Belorussian SSR 1980-2005 (in five-year periods) and predictions on the republic's population, which are being used by the Belorussian SSR Gosplan during preparation of the main directions in Belorussia's economic and social development during the 12th Five-Year Plan and for the period through the year 2000. Studies on the Belorussian SSR's contribution to sociopolitical, economic and cultural cooperation with the fraternal countries of socialism were conducted and published, a multiple-volume study of the artistic experience of Belorussian literature in depicting the heroism of the Great Patriotic War was published, and work was completed on a 7-volume collection on the historical and cultural monuments of Belorussia and on two of the three volumes of "A History of the Belorussian Theater" and so forth.

In mathematics and physics important theoretical problems were solved that will help in dealing with the specific problems problems facing the republic's national economy. Tangible results were obtained in the field of improving the reliability and prolonging the service life of machines and in developing nondestructive testing methods and new polymer and fiber materials.

Important results were obtained in major avenues of research such as agricultural plant selection, the treatment of various human and animal diseases, and research on the processes taking place deep inside the living cell.

One special place in the work of the academy institutes, V.A. Pilipovich remarked, is the completion of all-union and republic scientific and technical programs. He cited examples and talked about some of the results obtained in these tasks.

Together with the BelavtoMAZ, the Institute of Mathematics developed a mathematical model for the movement of a vehicle simulating actual driving conditions. A special program was developed for this and passed on to the plant.

The Institute of Machine Reliability and Durability conducted comprehensive studies on the reliability of hydromechanical transmissions for promising models of mainline trucks with more powerful engines. In cooperation with BelavtoMAZ, experiments were conducted to study the reliability of assemblies and parts in large dump trucks, and methods were developed for prolonging their service life. Together with the Gomel Lathe Assembly Plant, planning documentation was prepared for an industrial test installation to put wear-resistant coatings on parts using the method of induction sintering.

The Institute of Mechanics of Metal Polymer Systems and BelavtoMAZ proposed a technological process for fabricating metal polymer plain bearings.

A considerable proportion of the tasks in the republic programs was aimed at completing tasks set by the country's Food Program. In particular, the Institute of Genetics and Cytology and the Belorussian SSR Ministry of Agriculture Belorussian Scientific Research Institute of Agriculture developed new hybrids of long-stemmed flax that are lodge resistant and disease resistant and yield a high-quality fiber.

The staff of the Institute of Microbiology and specialists from the Nesvizh Fodder Biomycin Plant developed new technology for making fungus-based protein-vitamin preparations using straw, sawdust and potato peelings as the raw materials. The innovation was tested under production conditions and passed on to the Belorussian Scientific Research Institute of Experimental Veterinary Science, where the first test batch of this preparation was made.

Within the framework of the comprehensive program "Basic Science for Medicine" a series of studies was conducted whose findings are being used extensively in therapeutic establishments not only within the republic but throughout the country. The Belorussian Scientific-Production Blood Transfusion Association and the Moscow City Scientific Research Institute of First Aid imeni N.V. Sklifosovskiy proposed preparations that prolong the shelf life of stored blood. A mathematical model was developed for calculating treatment regimes in laser photocoagulation therapy in diseases of the retina.

The results from these and other tasks in the republic scientific and technical programs have found practical application and have generated considerable savings.

Filters fabricated in a special design bureau and Belorussian SSR Academy of Sciences production testing facility will become reliable instruments in studying Halley's Comet. The quality of the spectrozonal images of the nucleus of this space traveller will depend on them.

The Institute of Mathematics extended the introduction of software for the YeS computers, and some 2,110 organizations in the republic and throughout the country are now subscribers to this software store.

A new technological process that the Physical Technical Institute proposed for the Tula Machine Building Plant imeni V.M. Ryabikov has provided an annual saving of almost R550,000. The return is also high from processes for rapid electrothermal processing of special alloys and from an installation for electrocontact heating developed at this institute and now successfully operating at one of the plants in Smolensk.

A method for studying and testing portable film solar-powered water desalination units developed by the Institute of Heat and Mass Transfer makes it possible to reduce the weight of the items while still meeting the requirements for viability, and the saving from this innovation was R800,000. At the Saransk and Penza medical preparation plants they are using drying installations developed at the Institute of Heat and Mass Transfer. The total saving from their introduction has topped R340,000, and equipment productivity has been improved, prime costs cut and quality improved.

The Institute of Technical Cybernetics has passed on to many enterprises in various cities systems for automated planning and technological preparation for the production of articles and certain other innovations. Their total saving effect is about R1.5 million.

The Institute of Problems of Machine Reliability and Durability has carried out a complex of measures in the Soyuzgidravlika Production Association to improve the reliability of hydraulic drive systems, and has tested new methods and means for testing various devices and new technological processes, and it has improved the design of individual power units. All this has made it possible to double the reliability of hydraulic devices, save nonferrous metals and sharply reduce losses from equipment down time.

In 1983 the total saving derived from the introduction of 304 developments by the academy institutes totaled more than R120 million. The largest contributions were made by the institutes of technical cybernetics, electronics and mathematics and the physical technical institute. Academy science is providing a real and materially tangible return: in economic contract work with enterprises in the republic the return is R5 of profit for each R1 spent.

The speaker went on to note that the great authority of the Belorussian science can be seen in its broad recognition by international scientific organizations and institutions. The figures are eloquent: more than 100 Belorussian SSR Academy of Sciences inventions have been patented abroad. Last year alone four licensing agreements were signed.

In order to improve invention activity within the academy, reviews and competitions were held for the best presentation of invention work, the best invention and rationalization proposal, and the best invention among junior scientists.

In conclusion, V.A. Pilipovich dealt with the problems of training scientific personnel and questions of providing support for research work.

The following took part in the discussion on the report: academicians of the Belorussian SSR Academy of Sciences N.V. Birillo and R.G. Garetskiy, corresponding members of the Belorussian SSR Academy of Sciences V.I. Parfenov, V.S. Burakov, N.I. Arinchin and V.D. Tkachev, and doctor of technical sciences S.A. Astapchik.

Scientific reports were presented. Academician of the Belorussian SSR Academy of Sciences N.Ye. Savchenko talked to those present about the possibilities of reconstructive surgery in urology. The statement by corresponding member A.D. Zakrevskiy was devoted to problems of designing and using microprocessor systems.

The following participated in the work of the session of the Belorussian SSR Academy of Sciences annual general meeting: Belorussian Communist Party Central Committee secretary A.T. Kuz'min, deputy chairman of the Belorussian SSR Council of Ministers V.I. Kiritskiy, and Belorussian Communist Party Central Committee Science and Education Institutions Department chief Yu.P. Smirnov.

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GENERAL ASSEMBLY OF UKRAINIAN SSR ACADEMY OF SCIENCES

Kiev PRAVDA UKRAINY in Russian 31 Mar 84 pp 1, 3

[Article (RATAU): "Increase the Contribution of Scientists to the Acceleration of Scientific and Technical Progress"]

[Excerpts] At the present stage of the building of communism, when the Soviet people are implementing the large-scale program of economic and social development, which was outlined by the party, the role of science, which in fact has become an immediate productive force, is especially increasing. Guided by the decisions of the 26th party congress and the subsequent plenums of the CPSU Central Committee, the assumptions and conclusions, which are contained in the speeches of General Secretary of the CPSU Central Committee Comrade K. U. Chernenko, the scientists of the Soviet Ukraine are striving to increase their contribution to the acceleration of scientific and technical progress and the fulfillment of the plans of the 11th Five-Year Plan. By strengthening the creative ties and the practical alliance with the collectives of the USSR Academy of Sciences and scientists of all the union republics, the collective of many thousands of the Ukrainian SSR Academy of Sciences has achieved significant results.

The basic results of the activity of the Ukrainian SSR Academy of Sciences in 1983 and the tasks of its institutions on the development of scientific research and the increase of the contribution to scientific and technical progress were discussed at the session of the General Assembly of the Ukrainian SSR Academy of Sciences, which was held on 30 March in Kiev.

Prominent scholars, executives of the republic ministries and departments, scientific research institutes and higher educational institutions and industrial enterprises, representatives of party, soviet and public organizations and responsible officials of the Central Committee of the Communist Party of the Ukraine and the Ukrainian SSR Council of Ministers took party in its work.

Comrades V. V. Shcherbitskiy, A. F. Vatchenko, Yu. N. Yel'chenko, B. V. Kachura, A. P. Lyashko, I. A. Mozgovoy, A. A. Titarenko and A. S. Kapto; N. N. Panov, chief of a sector of the Science and Educational Institutions Department of the CPSU Central Committee; Deputy Chairman of the USSR State Committee for Science and Technology V. M. Kudinov; Deputy Chairmen of the Ukrainian SSR Council of Ministers S. I. Gurenko, V. A. Msol and N. F. Nikolayev; F. M. Rudich, chief of the Science and Educational Institutions Department of the

Central Committee of the Communist Party of the Ukraine, and the members of the Presidium of the Ukrainian SSR Academy of Sciences were in the Presidium of the General Assembly.

President of the Ukrainian SSR Academy of Sciences Academician B. Ye. Paton delivered the report.

Member of the Politburo of the CPSU Central Committee and First Secretary of the Central Committee of the Communist Party of the Ukraine V. V. Shcherbitskiy, who was warmly greeted by those present, spoke at the assembly.

Increase the Efficiency of Basic Research

Last year, it was noted in the report of President of the Ukrainian SSR Academy of Sciences Academician B. Ye. Paton, the collectives of the scientific institutions of the academy made significant gains in many fields of science and increased appreciably the efficiency and quality of research. The theoretical level and significance of developments increased substantially, the contribution of scientists to the solution of urgent national economic problems increased. They received 1,914 authorship certificates for inventions, more than 1,350 works of scientists were introduced in the national economy of the country, an economic impact of 1.55 billion rubles was obtained. The Institute of Electric Welding imeni Ye. O. Paton and the Institute of Problems of Material Science for the successful fulfillment of the plans and socialist obligations were awarded the Challenge Red Banner of the CPSU Central Committee, the USSR Council of Ministers, the All-Union Central Council of Trade Unions and the Komsomol Central Committee.

The activity of the academy on the intensification and broadening of basic research, first of all purposeful research, the development of advanced processing methods on the basis of the results of this work and their large-scale introduction in the national economy received the approval of the Presidium of the USSR Academy of Sciences.

Among the most important basic studies there were named, in particular, the theory of multifrequency oscillations, which was developed at the Institute of Mathematics and makes it possible to study complex phenomena in nuclear physics, nonlinear mechanics, microelectronics, radio and electrical engineering, as well as the theoretical principles of the designing of computers of new generations, which were developed at the Institute of Cybernetics imeni V. M. Glushkov and broadened the possibilities of the development of computer equipment. A theory and method of studying the plutonic structure of the earth in accordance with a set of geophysical methods were proposed by scientists of the Institute of Geophysics imeni S. I. Subbotin, which made it possible to develop a complex geophysical model of the tectonosphere of Europe. The contribution of the collective of the Institute of Electric Welding imeni Ye. O. Paton to the development of science is significant. Its research promoted the development of a new direction in the physical chemistry and technology of inorganic materials and the elaboration of the scientific principles of space material science. The research of power engineers, chemists and biologists was successful.

The problems, on which scientists in the field of the physics of nonlinear phenomena, solid state and low temperature physics are working, were revealed in the speech of Academician of the Ukrainian SSR Academy of Sciences V. G. Bar'yakhtar, Academician Secretary of the Physics and Astronomy Department of the Ukrainian SSR Academy of Sciences.

Corresponding Member of the Ukrainian SSR Academy of Sciences L. N. Litvinenko, deputy director of the Institute of Radio Physics and Electronics, reported at the assembly on the work being performed by Kharkov astrophysicists. By means of a unique radio telescope of the decameter range the scientists of this institution are studying rotating neutron stars--pulsars, are compiling a catalogue of galactic and extragalactic discrete sources and are studying the interstellar region--the areas of ionized hydrogen, the radiation of the quiet sun and various types of solar bursts. Decameter radio-frequency emission of single discharges of lightning in the atmosphere of Jupiter was detected here for the first time by ground facilities.

While specifying the directions of further work and the methods of increasing its efficiency, the assembly participants focused attention on the main tasks of the academy. Here it was specially emphasized that, when developing scientific research, priority should be given in the future to purposeful research, which, being basic by its nature, should be oriented toward the meeting of specific socioeconomic needs of society. The development of optical computers with the direct input of information through a video channel, which will hold an important place in the 21st century, can serve as an example. The use of new ceramic, composite and amorphous materials, as well as coatings will afford extensive prospects in many sectors of industry. Their importance can be compared with the appearance of aluminum in the 1920's. The studies of the physicochemical properties of the surfaces of solids for the purpose of increasing the efficiency of catalysts are acquiring great urgency.

The need to develop more vigorously the purposeful basic research, with respect to which a specific theoretical reserve is already available, was indicated in the report and the speeches. It is important to analyze carefully the level and importance of the achieved results and to specify clearly the directions, the development of which may lead in the immediate future to important results.

It is necessary to strive for the elaboration of really urgent, key themes, which correspond to the greatest extent to the needs of current socioeconomic development. In this connection the institutes and their problem councils should elaborate well thought-out, sound suggestions. The role of the problem councils in the use of goal program methods of the organization of basic research should be more active.

The Achievements of Science in Service of the National Economy

The need for the greater and greater orientation of scientific research toward the requirements of production and the realization of developments in the interests of various sectors of the economy was discussed at the assembly. Academician B. Ye. Paton and the speakers in the discussion noted that the Presidium of the Ukrainian SSR Academy of Sciences, its sections, departments and

institutions in their activity regard as of paramount importance the increase of the contribution to the solution of national economic problems and the development of advanced processing methods on the basis of basic research and are concerned about the acceleration and the increase of the scale of the introduction of the results of research and about the strengthening of the creative ties with production. The collectives of the academy took part in the accomplishment of the assignments of 135 union and republic programs, which are being implemented in the interests of many sectors of the national economy.

The key tasks, which were posed in the decisions of the 26th party congress and the subsequent plenums of the CPSU Central Committee and were clarified in the decree of the CPSU Central Committee and the USSR Council of Ministers "On the Measures on the Acceleration of Scientific and Technical Progress in the National Economy," are a guideline in the daily work of scientists. The specific tasks, which follow from this decree, were discussed at a meeting of the Presidium of the Ukrainian SSR Academy of Sciences. In the republic the Council for the Promotion of Scientific and Technical Progress headed by Comrade V. V. Shcherbitskiy has been set up and is operating under the auspices of the Central Committee of the Communist Party of the Ukraine. The activity of the council is having a beneficial influence on the increase of the efficiency of production and science itself.

The extensive automation of technological processes and the use of automated machine tools and mechanisms, robotic complexes and computer equipment were named at the assembly as the most important directions of the retooling of production. Scientists jointly with production workers have to develop and increase the scale of use of advanced energy-saving and resource-saving technologies. The task of providing during the current five-year plan an economic impact of not less than 1 billion rubles by the use of electroslag and powder technologies, the application of protective coatings, modern methods of the processing and storage of food products, as well as biolotechnologies faces the collectives of the academy, the ministries and departments of the republic.

For the further intensification of the economy, it was noted in the speeches, it is very important to develop fundamentally new processing methods and equipment, such as would conform to the world level or exceed it. The collectives of the Institute of Electric Welding imeni Ye. O. Paton, the Institute of Problems of Material Science and a number of others are guided precisely by these requirements. Academician V. S. Mikhalevich, director of the Institute of Cybernetics imeni V. M. Glushkov, in his speech spoke about the prospects of the further automation of production and the specific contribution of the cyberneticists of the republic to the accomplishment of this task.

The reader of the report and the speakers devoted much attention to the means of the acceleration of technical progress in metallurgy and the development and assimilation of technological processes, which ensure the increase of the quality of metal and the enlargement of the product mix. It was noted that in this leading sector of heavy industry the questions of the increase of the level of the mechanization and automation of difficult and labor-consuming operations and the extensive introduction of industrial robots and automated control systems of technological processes are acquiring particular urgency. Ukrainian SSR Minister of Ferrous Metallurgy D. P. Galkin said in his speech

that the workers of the sector are also counting on the assistance of scientists in the development of processes of the complete utilization of waste products in case of the extraction and concentration of iron and manganese ores and the development of new methods of preparing scrap metal for remelting.

The role of scientific collectives in the implementation of the Energy Program, the speakers stressed, is great. Here large-scale developments, which are capable of having a substantial influence on technical progress in the sector, are especially necessary, Ukrainian SSR Minister of Power and Electrification V. F. Sklyarov and other speakers pointed out in their speeches.

Scientists, it was noted at the assembly, have to make a search for new sources of energy, methods of its conversion into electric power and means of the optimization of the balance of energy consumption and have to create a scientific reserve for the leading development of nuclear power. One should deal more objectively with the accomplishment of the tasks of the increase of the reliability and degree of economy of thermal and nuclear electric power stations and the development of systems of highly efficient power equipment. It is necessary to continue the research, which is aimed at the increase of the proved reserves of coal in the Donetsk Basin and the introduction of the complete mechanization and automation of production processes in the mines.

The questions of the implementation of the Food Program took up much space in the report and the speeches. The institutions of the Ukrainian SSR Academy of Sciences, Vice President of the Ukrainian SSR Academy of Sciences I. I. Lukinov noted, have actively joined in its implementation and are launching research, which is aimed at the acceleration of scientific and technical progress and the search for the most effective means and methods of the management of the agro-industrial complex. Many institutes of all three sections of the academy are taking part in the elaboration of these most important problems. These operations have to be intensified substantially, on the basis of the tasks which were posed at the All-Union Economic Conference on the Problems of the Agro-Industrial Complex. The research in the area of the increase of the reliability and efficiency of the operation of machine systems and the development of fundamentally new processing methods of the resource-saving type for the industrial processing of agricultural raw materials and the decrease of their losses is of especially great importance. Such operations are yielding a significant national economic impact.

Corresponding Member of the Ukrainian SSR Academy of Sciences V. V. Smirnov, director of the Institute of Microbiology and Virology imeni D. K. Zabolotnyy, Academician of the Ukrainian SSR Academy of Sciences M. F. Gulyy, chief of a division of the Institute of Biochemistry imeni A. V. Palladin, and others spoke about how significant the yield of scientific research on the problems of the agro-industrial complex could be, if it is conducted purposefully and persistently. Corresponding Member of the Ukrainian SSR Academy of Sciences V. P. Kukhar', Academician Secretary of the Chemistry and Chemical Technology Department of the Ukrainian SSR Academy of Sciences, in his speech directed attention to the need for the intensification of the work on the development and extensive introduction of biotechnologies.

In order to substantially increase the scale and accelerate the process of the introduction of scientific developments, it was indicated at the assembly, it

is necessary to strengthen constantly the experimental design and production base, which exists in the Academy of Sciences, and to improve its organizational structure, the specialization and cooperation of various works. They should create for the institutes the appropriate conditions for the development of basic research and the fulfillment of the assignments of the scientific and technical programs. They should cooperate more closely with the experimental works of ministries and departments.

Solve the Key Problems in Combination

The most important task of scientists, it was stated in the report of Academician B. Ye. Paton, is to intensify the work on the implementation of the comprehensive program of the acceleration of scientific and technical progress in the republic. It is necessary to increase the extent of their participation in the republic comprehensive programs "The Materials-Output Ratio," "The Energy Complex," "Metal" and others and to strive for the fulfillment of the really important assignments which ensure radical changes in production. The scale of introduction should be one of the most important indicators of this work. Today it is already insufficient to use innovations at one or even several enterprises. Emergence in the sector, a large number of sectors of the national economy--that is what the collectives of scientists should strive for.

The work, which the scientific centers of the Ukrainian SSR Academy of Sciences are performing on the comprehensive solution of the scientific, technical and socioeconomic problems of the regions of the republic, was analyzed at the assembly. It was noted that the Presidium of the Academy of Sciences and the bureaus of the scientific centers are devoting considerable attention to the fulfillment of the contracts on scientific and technical cooperation between the academy and the oblasts of the republic and to the assurance of the large-scale introduction of the developments of collectives of scientists. The work of the centers in the oblasts, where there is no developed scientific base, has become more perceptible. The holding of joint meetings of the bureaus of the scientific centers and the scientific coordinating councils, which operate in the oblasts, to a significant extent was conducive to this. Urgent questions were examined at such meetings in Vinnitsa, Zaporozhye, Kirovograd, Crimean, Nikolayev and Khmelnitskiy Oblasts. Much of what was planned is already being implemented.

The decree of the CPSU Central Committee "On the Work of the Ural Scientific Center of the USSR Academy of Sciences," the speakers said, is of great mobilizing importance for the increase of the efficiency of the work of scientific centers. It directs the attention of scientists to the solution of the urgent problems of regions, the setting up of scientific production cooperation with enterprises of different sectors and the rapid introduction of the results of science in practice.

Academician of the Ukrainian SSR Academy of Sciences N. G. Chumachenko, chairman of the Donetsk Scientific Center, told about how the work of its collective in this direction is being improved. The scientists of the center are taking part in the accomplishment of a number of important regional tasks. With their participation in 3 years at many enterprises of the oblast advanced processing methods were adopted, flow and mechanized lines were put into

operation, the production of a large volume of high quality products was assimilated; the economic impact from these measures came to about 500 million rubles. The elaboration of the comprehensive scientific and technical program "The Renovation and Retooling of Industry of the Donbass" has been started by the forces of the scientific center.

The scientists of the scientific centers, it was indicated at the assembly, should intensify the work in the unified complex of the Ukrainian SSR Academy of Sciences. The formulation of regional scientific, technical and socioeconomic programs for the 12th Five-Year Plan and the assurance of their high quality are their foremost task. It is important for the programs to be aimed at the solution of the key problems of the regions and to envisage the combination of the efforts of organizations of different departmental subordination.

The reader of the report and the speakers devoted much attention to the questions of the improvement of the forms of contact of science and production, emphasizing that the rate and scale of the introduction of innovations depend to a decisive extent on this. I. D. Nagayevskiy, general director of the Zhdanovtyazhmash Production Association, spoke about the need to solve in combination the key problems of the machine building sectors by the joint efforts of academic and sectorial institutes. The work of the specialists of this association with the Institute of Electric Welding imeni Ye. O. Paton and other scientific collectives, which is being carried out on the basis of long-term programs, is yielding an appreciable impact.

Academician of the Ukrainian SSR Academy of Sciences Ya. N. Belevtsev, deputy director of the Institute of Geochemistry and Mineral Physics, and Academician of the Ukrainian SSR Academy of Sciences V. N. Poturayev, director of the Institute of Geotechnical Mechanics, having dwelled on the questions of the improvement of the methods of geological prospecting and the development and introduction of new technologies of the extraction and processing of the iron ores of the Krivbass, spoke about the need to broaden substantially the front of scientific research in these directions.

The questions connected with environmental protection, it was noted at the assembly, require a comprehensive approach. The intensification of the work on the development of a waste-free and resource-saving technologies, the commitment of production waste products to the economic turnover and the implementation of other conservation developments is a responsible task of scientists.

The assembly participants spoke about the great responsibility of scientists for the acceleration of the rate of scientific and technical progress and about the need to improve the style of work of scientific institutions, to devote more attention to the training and education of personnel, to tighten up discipline and to carry out the effective monitoring of the fulfillment of the outlined plans.

The tasks of the scientific institutions of the Ukrainian SSR Academy of Sciences on the development of research and the increase of the contribution to scientific and technical progress were noted in the decree, which was adopted by the General Assembly.

At the assembly diplomas and medals were presented to the winners of the prizes of the name of outstanding scientists of the Ukraine and of the prizes of the Ukrainian SSR Academy of Sciences to young scientists and students of higher educational institutions for the best scientific works.

The directors of the scientific institutions, who were elected at the general assemblies of the departments of the Ukrainian SSR Academy of Sciences, were approved.

The changes in the Charter of the Ukrainian SSR Academy of Sciences, the Statute on the Department of the Ukrainian SSR Academy of Sciences and the charter of the scientific research institute of the Ukrainian SSR Academy of Sciences were also approved.

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KIRGHIZ PROBLEMS IN IMPLEMENTING SCIENTIFIC INNOVATIONS

Frunze SOVETSKAYA KIRGIZIYA in Russian 14 Mar 84 p 3

[Article by B. Amanov, chief of the Science and Technology Department of the Kirghiz SSR State Planning Committee: "The Client of Science in the Five-Year Plan"]

[Text] Scientific ideas originate first of all as a result of basic research, but their ultimate goal is implementation in production and in the national economy. At the February CPSU Central Committee Plenum in the speech of Comrate K. U. Chernenko the task of today was heard with the maximum clarity: "Intensification, the rapid introduction in production of the achievements of science and technology, the implementation of large-scale comprehensive programs--all this in the end should raise to a qualitatively new level the productive forces of our society."

In Kirghizia the capital-labor ratio has increased to a decisive extent not due to the renovation, modernization and increase of the level of the technical equipment of operating enterprises, but mainly by the expansion of the production capacities.

The plans of the use in the national economy of the achievements of science and technology for the republic as a whole are not being fulfilled. For example, the 1983 plan was fulfilled by only 87 percent. Here the enterprises of the Ministry of the Construction Materials Industry coped with them at the level of 47 percent, the Ministry of the Fruit and Vegetable Industry--71 percent, the Ministry of Trade--78 percent. In the Ministry of Motor Transport and Highways the plan was fulfilled by 81 percent, in the Ministry of Construction--82 percent. Such important assignments, which ensure the increase of labor productivity, as the introduction of automatic manipulators with programmed control at the Frunze Computer Plant and the Min-Kush Orgtekhnika Plant and mechanized flow lines at other enterprises were upset.

The inadequate influence of scientific and technical progress on the increase of production efficiency is due to many reasons, but the main ones are, first, the incomplete interest of enterprises and ministries in the introduction of new equipment and technology due to the imperfect system of pricing of new products and the lack of an orientation toward the consumer properties of new equipment. Second, there are no sufficiently precise criteria and an effective mechanism of the choice of the most efficient developments and design

decisions. Economic conditions have made it possible to carry out for a long time unpromising developments which, besides, are unjustifably duplicated, but force their clients to treat exactingly the choice and acceptance of the proposed plans.

At the same time the analysis of the activity of the machine building enterprises of the republic also showed the negative influence of the assimilation of new equipment on the economic indicators. It appears, first of all, in the increase of the labor intensiveness, which decreases the labor productivity. At the Plant imeni V. M. Frunze and the Plant of Instrumentation the labor productivity during the fourth year of the output of new products comes respectively to 96.1 and 72.7 percent of the productivity which existed prior to the changeover to the production of new equipment. The increase of the labor intensiveness is due, as a rule, to the lack of equipment accessories, the low proportion of technically sound norms and the weakening of the relations with the suppliers and users of the finished product. This inevitably entails a decrease of the production volume and, hence, the material incentive fund and thereby decreases the interest of enterprises in the assimilation of new products.

When drawing up the Basic Directions of the Economic and Social Development of the Kirghiz SSR for the Future the republic State Planning Committee came across cases, when individual ministries were planning for the coming five-year plan too low a growth rate of labor productivity. In particular, the Ministry of Light Industry with an average annual rate of increase of 2.9 percent, which was achieved during 1981-1983, is planning only a 1.2-percent annual increase of labor productivity. Is it any wonder that the share of the increase of output during the next five-year plan due to the increase of this indicator will amount for the sector to only 52 percent? This is much less than has already been achieved now.

The republic Ministry of Construction is also envisaging such "modest" rates. Does this not really testify that in a number of sectors of the economy they have not yet made and, judging from the plans for the future, are not about to make a sharp turn in the direction of intensive methods of management?

In order to improve the management of scientific and technical progress in the national economy of the republic, it is necessary, in our opinion, to draft specific, practical plans of the retooling of enterprises, having made them some of the basic sections of the five-year plan. The systematic replacement of fixed capital should envisage the stages and dates of the accomplishment of renovation. While they, in turn, should follow from the tasks of the intensification of production. In other words, it is necessary to eliminate the possibilities of the expansion of capacities without the economically justified reorganization of the processing method. In order to stimulate the assimilation of advanced types of products which correspond to the highest technical level, the USSR State Committee for Science and Technology proposed to use wholesale price markups of up to 30 percent. In those instances when it is necessary at the same time to expedite the assimilation in production of new items and to enlarge the sphere of their use, it is recommended to set higher prices for the producers and lower prices for the users. The difference will be covered by means of the unified fund for the development of science and technology in the sectors or by means of assets of the state budget, which

have been allocated for the implementation of the corresponding scientific and technical goal programs.

Moreover, it is necessary to ensure the real interconnection of the plan on the introduction of the achievements of science and technology with the plans of economic and social development. For this the key tasks and the direction of the scientific research work, which is aimed at the elimination of the bottlenecks in the national economy, are specified in the five-year and long-range plans.

This work is a kind of social order for science.

At present the Kirghiz SSR Academy of Sciences jointly with the republic State Planning Committee, ministries and departments have prepared, while the USSR State Committee for Science and Technology, the USSR State Planning Committee and the USSR Academy of Sciences have approved the Comprehensive Program of Scientific and Technical Progress of the Kirghiz SSR for 1986-2005. The most important socioeconomic, scientific and technical tasks for the distant future are specified in it.

The intensification of the development of the sectors of industry, which govern technical progress--power engineering and machine building--is envisaged. During the 12th Five-Year Plan the construction of the Nizhniy Naryn cascade of hydroelectric power stations with an aggregate capacity of 2.9 million kW will be completed, while for the period to 2000 it is expedient to carry out the construction of the Kambaratinskiy hydroelectric power stations with a capacity of 1.9 million kW. With the placement of these hydroelectric power stations into operation the contribution of the republic to the all-union division of labor will increase significantly, in particular, the national economy of the country will receive annually more than 18 billion kWh of inexpensive electric power, which will make it possible to save much of the gas and fuel oil, which are now being burned at the thermal power stations of Central Asia and Kazakhstan.

A policy of the use of automatic manipulators with programmed control, which in combination with specialized equipment will make it possible to develop versatile, rapidly adjustable technological systems, will be adopted in machine building. During the years of the 12th Five-Year Plan it is planned to introduce 132 automatic and mechanized flow lines, 173 NC machine tools, 125 manipulators and other highly productive equipment. This, of course, will specifically affect the increase of labor productivity.

The obtaining of alloy powdered iron from the production scraps of the Kirhiz Mining and Metallurgical Combine will contribute to the development of a waste-free processing method.

If we take into account that the use in metalworking of parts made from powders saves 2 tons of rolled products and frees up to 80 metalworking machines, it is difficult to overestimate the importance of powder metallurgy for machine building of the republic, which operates entirely on imported metal.

In the future important social tasks also have to be accomplished. The questions of the increase of the territorial mobility of the population and the

level of the vocational training of personnel, especially rural young people of the indigenous nationality, and the rapid mechanization and automation of manual labor will be especially urgent. And in the accomplishment of these tasks the word of science should be decisive.

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BRIEFS

ESTONIAN-SWEDISH SCIENTIFIC AGREEMENT--Stockholm--A protocol on scientific and technical cooperation between the Estonian SSR Academy of Sciences Institute of Chemical and Biological Physics and the "LKB-produkter ab", one of Sweden's leading instrument building firms, has been signed here. In an interview with a TASS correspondent the president od "LKB-produkter ab" (Stig Stendal) said that the protocol that has been signed is just one example of the fruitful mutual links between his firm and Soviet scientific research establishments and organizations that have been developed over a long period on the basis of an agreement on scientific and technical cooperation between the USSR State Committee for Science and Technology and "LKB-produkter ab." Very successful contacts are being extended with the Siberian Branch of the USSR Academy of Sciences, the USSR Academy of Sciences Institute of Bioorganic Chemistry imeni M.M. Shemyakin, and with scientists of the Moscow State University imeni M.V. Lomonosov. I would particularly like to stress, (S. Stendal) said, that these links are mutually advantageous and important for both parties. Research findings are used both in Sweden and the Soviet Union. A regular exchange of delegations of experts and specialists takes place between our firm and the Soviet organizations, and lectures and symposia are organized on various problems. In some cases this cooperation leads to commercial contracts. This is all opening up new prospects for deepening mutual links, which is in the interests of the Soviet Union and Sweden and of strengthening the relations of good-neighborliness and mutual understanding between our countries, (S. Stendal) stressed. [Text] [Tallinn MOLODEZH' ESTONII in Russian 22 Feb 84 p 1] 9642

NEW PREMISES FOR SCIENTISTS--A snow-white shell crowned with a chased bronze crown has been raised high above the Moskva River. The new complex of buildings for the USSR Academy of Sciences Presidium is going up on Gagarin Square. The view from the 21st storey is unique: beyond the curve of the river lies the sports complex of the Luzhniki, above which the building of the Moscow University towers up, and to the right, shaded in the mists on the horizon, the Kremlin. And now the landscape of the capital has been graced with another fine collection of buildings finished in the traditions of the Russian architectural style. Its main elements are two vertical towers. They contain the premises of the scientific sections and departments of the USSR Academy of Sciences Presidium, a main meeting hall with 1,600 seats, and a conference hall. The building will be equipped with an automatic control system for maintenance and housekeeping services, and high-speed elevators and escalators. Another interesting detail

is that the windows of the working offices will be made from tinted glass to provide protection from the sun. The complexity of the architectural concept caused many difficulties for assembly workers, especially when raising the high part of the new main headquarters of Soviet science. It will be crowned by two decorative bands of glass and polished aluminum. Most of this has already been completed up to the 100-meter mark. Assembly is being done using large prefabricated elements put together beforehand in the inner area of the building. Each element is rather large, weighing in at five tons. Even though the assembly workers from the Stal'montazh Trust have set up blocks even larger than these (weighing up to several tens of tons), there are complications enough. The decorative panels have a large "area of sail" and it is sometimes necessary to wait until the wind stops blowing before the next one can be put in place [By A. Dzhioyev] [Text] [Moscow IZVESTIYA in Russian 11 Mar 84 p 1] 9642

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